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PROFESSOR FRANK DEBENHAM (*by H. Andrew Freeth, ARA*)

THE POLAR RECORD

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FOREWORD

The Friends of the Polar Institute have long wished to record the service o Frank Debenham to the Institute both as founder and, until 1946, as its firs Director.

It was decided to commission a portrait of "Deb" and present it to th Institute. Our frontispiece is a photograph of the portrait-drawing painted b H. A. Freeth, A.R.A., and of a charcoal drawing by the same artist which ha been presented to "Deb" himself.

[Copies of the photographs, 5½ in. by 8 in., may be obtained from the Institute price 6*s*. each mounted or 4*s*. unmounted.]

TWO UNPUBLISHED ACCOUNTS OF THE BRITISH ANTARCTIC EXPEDITION, 1839–43

[*MS. received 9 February 1960.*]

[The British Antarctic Expedition, 1839–43, consisted of two Naval vessels, H.M.S. *Erebus* and *Terror*, with Sir James Clark Ross as leader and Captain F. R. M. Crozier as second-in-command. The objects of the expedition were mainly concerned with terrestrial magnetism, a subject of particular interest to Ross who had discovered the North Magnetic Pole in 1831. The expedition circumnavigated the Antarctic continent and made a number of important geographical discoveries. It twice penetrated the pack ice of the Ross Sea; it discovered, and roughly charted, 500 miles of new coastline in Victoria Land; it discovered Ross Island and the Ross Ice Front, also the James Ross Island group; it visited Prince Edward Islands, Îles Crozet and Îles Kerguelen; and it sighted Joinville Island and the Balleny Islands. Observations of terrestrial magnetism were made from stations, either permanent or temporary, set up during the voyage.

There are two main published accounts of the voyage, by Ross[1] and by Robert M'Cormick, surgeon aboard H.M.S. *Erebus*.[2] There are also two less-known narratives, both of which were extensively used by H. R. Mill in his *Siege of the South Pole*[3] and which came to the Scott Polar Research Institute on his death. The first is a letter from J. E. Davis, second master of H.M.S. *Terror*, to his sister, later printed[4] for private circulation. It describes the second expedition to the Ross Sea, which left New Zealand in November 1841. In reproducing this account, the illustrations and a number of personal references and reflections have been omitted. The other, an unpublished manuscript, is by C. J. Sullivan, Irish blacksmith of H.M.S. *Erebus*,[5] and appears to have been written for a shipmate who joined the expedition towards its close; it covers the discovery of Victoria Land during the first voyage to the Ross Sea, in January 1841, as well as incidents during the second voyage to the Ross Sea. The whole of the prose section of this manuscript is reproduced below.

The two narratives, often describing the same events, form an interesting reflection of the talents and backgrounds of the two men. Davis was an educated man, able to express himself in clear, if somewhat verbose, prose, and, in addition, an artist and draughtsman of considerable merit. Sullivan possessed little knowledge of grammar or spelling but wrote with spirit, using a surprisingly wide vocabulary. Occasionally he felt himself confined by his inarticulate pen, and wishes he could draw or paint scenes he cannot trust himself to describe in words; he then turns to poetry and finds relief in a remarkable faculty for bad verse, humorous and solemn, but not meriting reproduction.

The illustrations are of watercolours by Davis himself, now in the Scott Polar Research Institute.[6]

References

[1] James Clark Ross. *A Voyage of Discovery and Research in the Southern and Antarctic Regions during the Years 1839–43.* London, 1847.

[2] Robert M'Cormick. *Voyages of Discovery in the Arctic and Antarctic seas....* London, 1884.

[3] H. R. Mill. *Siege of the South Pole.* London, 1905.

[4] J. E. Davis. *A Letter from the South Pole.* Printed for private circulation, 1901.

[5] SPRI MS. 361/22.

[6] SPRI 59/5/1–6.

Ann Savours]

Extracts from J. E. Davis, "A letter from the Antarctic":

H.M.S. *Terror*, off Cape Horn
April 11th, 184

Dearest Emily...

Well, we sailed on the 22nd* and I was of course very sea-sick; we had been with little intermission six months in harbour, and I expected it.... On the 24th a man fell overboard from the *Erebus*, and although there was a heavy sea running he got hold of the life-buoy and was saved. We found out afterwards that he had jumped overboard to escape punishment which he richly deserved. They have been too lenient, for I believe fully that severity in the beginning is lenity in the end. However, he got his deserts. That ship is not nearly in such good order as this ship; there is too much familiarity between the men and the officers to please me, and that strikes at the root of all discipline... We could not go into Chatham Island as it was so very thick and foggy and it was blowing hard. We passed within a quarter of a mile of some breakers called the Sisters. They must be considerably out in their longitude, for by our reckoning we were well clear of them. It was fortunate for us it was during the day, for if it had been night we might have visited Chatham Island in a manner that would not be very agreeable. We passed this island on the 30th November. Our object was next to steer as far as 150° W., and then proceed to the southward on that meridian. About the 10th or 11th Decembe it became sensibly colder, and after the warm weather at New Zealand we felt cold with the thermometer at 35°. We began worsted socks and gloves then... About this time the ship was very uncomfortable, owing to the captain being very much out of temper and the gun-room officers quarrelling amongst themselves. They all succumb to the first lieutenant in a disgraceful way. There is a vast difference between respect due to a man's rank and succumbing to his whims and fancies. I am very glad I do not mess with him. I am very content here where there are only three of us and no superiority, although I cannot say that they are what I should choose; but I might have had worse and conceive it my duty to yield in some measure. We have got a very good rule, that is, if two of us quarrel and do not speak the third is not to speak to those two till they have made it up. However we have not had occasion to put that in force yet, and hope we shall not.

We now had light but fair wind and very foggy, which kept us constantly beating gongs, firing, and ringing bells to keep company with the *Erebus*. On the 15th we were in Lat. 58°, and congratulated ourselves on having made such progress and anticipated such great things; in fact, what we did last time was to be nothing to it. The next day we fell in with the first ice, consisting of large bergs, many of which we passed. I think the first sight of a large iceberg is one of the most magnificent and stupendous in nature, but the novelty soon wears off. We entered pack ice at 4 o'clock on the morning of the 18th in Lat. 63°, which is much farther to the northward than we did last season

[* 22 November 1841, from the Bay of Islands, New Zealand.]

for in this latitude then we had heavy gales and stove some of our boats. The weather was now beautiful, but cold, the temperature below the freezing point.... We were now continually sailing through ice, perfectly threading the needle, and the ice scraping along her sides kept a continual noise like distant thunder. Every now and then she would strike heavily against a piece that would make her shake again....

On Dec. 23rd the ice became much thicker and heavier, that is, in larger masses, so that the navigation became much more difficult, and we were obliged to bore—that is, pressing the ship through. Sometimes we lay alongside a piece of ice without moving for half an hour, at other times going through channels at first not the breadth of the ship, but by making sail regularly force our way through. It would perfectly astonish you could you see the immense masses we in this manner shove out of the way. Again at other times we had to shove her along with poles; this is very tedious work as well as slow....

On the 22nd we got soundings with 1700 fathoms, and the 23rd we made fast to a floe and watered the ship. While fast we killed a seal of the hair kind, caught three penguins of a kind unknown, and shot lots of white birds. These birds are only found in the antarctic regions; the proper name of them is, I believe, *Procellaria nivea*; they are beautifully white like the snow itself. I have got a couple stuffed.

On Christmas Day we were in Lat. 65°, but blocked up by the ice, just sailing round a pool of water. We all dined with the captain....On the 30th we got no farther than the Circle, and the ice was so close and thick that we could not proceed; the weather was thick and foggy, and the mist on the rigging froze as it fell, and as there was danger of fouling or losing each other, there not being room to work, we made fast to the same piece of ice, and of course being only about 50 yards apart there was a great deal of visiting, for we had but to walk across the ice to get to the *Erebus*. So we proposed to see the Old Year out and the New Year in in style on the 31st. I dined on board the *Erebus*, and after dinner Hooker (the assistant surgeon of the *Erebus*) and myself went on the ice and cut out in hard snow the figure of a woman, which we called our "Venus de Medici". She was made sitting down and about eight feet long, and as the snow froze very hard she remained perfect till we left the floe. I assure you that (although I says it as shouldn't) it was not badly executed, and was the cause of a good deal of fun, and was much criticised; after that we cleared away a room by cutting down to the solid ice, and built a table in it, on which to drink the Old Year out and the New Year in. At a few minutes before twelve you would have been stunned with the noise that was made, each ship trying to beat the other—blowing of horns, beating of gongs, squealing of pigs (for the men took the latter under their arms to make them make a noise), and all kinds of diabolical music—and at twelve it was increased by each ship ringing forty-two bells, which is called ringing the New Year in. We then all (I mean the officers of course) assembled at our refreshment room on the ice between the ships where the two captains soon joined us. Captain Ross was in high spirits, shaking hands with everybody and wishing them a Happy New Year. He then drank the health of all

our men (for they were all up), the hands having been turned up to "Splic the main brace." They then cheered him, and the same thing was done b Captain Crozier to the *Erebus*, and after some more drinking and cheering w separated for the night, or morning....

Well, after breakfast we received our New Year's Gift from the Queen that is a jacket, pair trowsers, two pairs boot hose, two comforters, two pair mittens, one red shirt, a Welsh wig, a knife, and some thread, the boots bein reserved for next year. So my kit will be increased considerably in quantity The red shirts are very handy as they last a fortnight; I have not had on white shirt since I left the Bay of Islands. We all dined together in the gun room, and after dinner, at about eight in the evening, we all went to a bal room having been previously cut, with sofas all round, of course all made o snow. Flagstaffs were planted with the Royal Standard; two or three sill Union Jacks, besides other flags, presenting, I assure you, a very gay ap pearance. I must mention the sign-boards (for it was supposed to be an inn) one was "The Erebus and Terror," and the other, rigged on a boat-hook staf and an ice-axe, presented the figure of Bacchus in one corner and Britannia i another, and something else equally fine in the others, but it puzzled m powers of discernment to decipher what they were intended to represent But in the centre was painted "The Pilgrims of the Ocean," and on the revers ..., "The Pioneers of Science," at which Captain Ross was greatly amused On the signal being given (a gun from the *Erebus*) the two captains made thei appearance (under a rather irregular salute of musketry from a party of th men rigged as a guard of honour) and took their seats on a raised snow sofa and soon after the ball commenced. Of course Captain Crozier and Miss Ros opened the ball with a quadrille; after that we had reels and country dances Ices and refreshments were handed round, the former in the greatest profusio (the boatswain of the *Erebus* performing the part of host under the title o Mr. Boniface). You would have laughed to see the whole of us, with thic overall boots on, dancing, waltzing and slipping about, and all the fu imaginable going on. Ladies fainting with cigars in their mouths, to cur which the gentlemen would politely thrust a piece of ice down her back But it would require a "Boz" to give any idea of the ridiculous scene; it wa beyond all description, and the best of it was there was not an ill word the whol time, although there were some very heavy falls and many a sore face fro the blows of the snowballs. All was taken in good part, and, as the Vicar o Wakefield says, "What was wanting in wit was made up in laughter." N accident occurred to me, without I may mention that a lady burnt the bac of my hand with a cigar. In the next room some of the men were playin "Bell the cat." At about one o'clock as the captains left we first pelted the with snowballs and then cheered them, both of which honours they took wit equally good humour. After a great deal of fatigue (for it is hard work dancin in such heavy clothing, especially as we use a little more exertion than w would at a ball on shore) I was glad to get to bed at three o'clock in th morning, and I quite forgot it was Sunday morning, and in fact Sunday wa a complete day of rest. I afterwards did a bit of a picture of the scene which ha

been greatly praised.... The next day, to end the festivities, the men had racing in sacks, catching a pig with a greased tail, and climbing a greased staff for a prize, which created a great deal of amusement and fun.

We now began to tire of each other's company, and on the 6th we cast off, the ice appearing slack to the southward. We left a cask with a paper in it on the ice, signed by all the officers of both ships, and my Venus was left entire. We did not make much progress, for we were stopped next day. We might have gone to the westward, but Captain Ross was determined to go eastward as Bellinghausen, the Russian navigator was obliged to turn back, and I think he thought there was land near. We caught a seal 11 feet 4 inches long here, and some enormous penguins weighing upwards of 70 pounds, but the largest we caught afterwards weighed 79—I think about the largest ever caught. The *Erebus* caught a seal larger by a few inches in length, and weighing upwards of 800 pounds.

Jan. 9th. On the same spot we were Christmas Day, and blowing hard, so we were in hopes it would break the ice up; but alas, no, we were in despair, fearing we should not get beyond Weddell. There appeared no prospect of it; still, Captain Ross persevered, and I believe he was the only person that said it was capital, just the thing he wanted. I think he wanted to make the best of a bad bargain; but he said he never looked at the dark side of things, and he was right. We again made fast to a floe piece on the 15th, and the ice was very close and heavy, and, it blowing a strong breeze to the southwestward, we made sail, towing the immense piece of ice. She kept striking so heavily as to keep all the bells ringing. On the 18th, in the afternoon the weather became very thick and misty; at about half past five we found ourselves close to a large berg, in very dangerous proximity. We were obliged to make all sail, still keeping fast to our floe, and just cleared it; it was an immense mass, and through the mist appeared more so than it really was. We were drifting right down on it, and there was a heavy swell on at the time; the next morning it was blowing very hard. The *Erebus* carried away two hawsers and lost two ice anchors, and we lost one of each....

On the morning of the 20th it blew a heavy gale of wind; there we were in the midst of very heavy ice with a very heavy swell on. The ship at times striking hard, it was very difficult to pass clear of the largest pieces which threatened at times to crush us. We had no sail set but the main-top sail clewed down, and set the fore-stay sail now and then to forge her ahead. At times we could not see the *Erebus's* top-mast-bends, the swell was so high (and she was close to us). Sometimes we thought that the pieces we came against would grind us to powder; and in fact no ordinarily built ship would have stood such a hammering for half an hour, it would soon have knocked a hole in her bottom. We were afraid for our bowsprit, it being so low, but we experienced a greater loss in our rudder, which was broken and rendered useless at ten in the forenoon. A tongue of ice got under it and completely ground it round, splitting it all the way up, tore two of the braces of the gudgeons out of the stern-bolts and carried away three of the pintles (all of which were the size of a line-of-battle ship's), and the rudder as it was was immovable.

The *Erebus* also wrung the head of hers. Here we were then, two unmanageable ships drifting about in an unknown sea, expecting land to be under our lee, and no possibility of helping ourselves. We got our spare rudder up, and put it together, but could do nothing more, and we had a doubt whether it would ship or not owing to the gudgeons being torn away. I suppose the Dockyard men thought that impossible, and, instead of having spare gudgeons between the others and pintles on the spare rudder to match, they were both fitted alike.... How anxiously did we watch the barometer, for it went lower (with one exception) than we had ever had it before. The weather moderated towards evening, and the next day (the 21st) we were enabled to make fast to a piece of ice, which I assure you we were very glad to do. We immediately examined all our damage. The *Erebus's* rudder was soon repaired and we patched up ours as a spare one by scarfing it and filling up with oak plank, and hooping it round with ice saws which we were obliged to cut up for the purpose. We had great difficulty in shipping the spare one, owing to the remaining gudgeons being bent, and after trying for a whole day we managed it, and it is now holding by three instead of six. Our other damages were not much; both ships lost a great deal of copper, which was curled up like brown paper, a great deal of it about the bows being 80 oz., or nearly three times the usual thickness. All the steps on the sides were torn off, and we carried away a spare top-sail yard which protruded a little too far out. Every one said they had never seen or experienced such an awful day. Those that had been to the north confessed that in all their dangers there they had nothing equal to that. The usual smile had gone from Captain Ross' countenance and he looked anxious and careworn. They said he was most anxious for this ship, she having been so badly handled to the northward, which she has never recovered. The day after making fast was Sunday; we were at work all day and night, but they had church in the *Erebus*, and it may give you an idea of what Captain Ross thought of it when he said that beautiful prayer of thanksgiving in the "Forms of Prayer to be used at Sea," commencing "Oh most mighty and gracious good God," returning thanks for our escape from imminent danger. It was the first time I have ever known it to be read publicly. We have broken up one of our whale boats which had got smashed while hanging at the stern the day before the gale....

We cast off on the 27th and made a little southing, and made fast again on the 29th. We had a great alarm on the 27th, the day we cast off; the weather being very damp, and the lower deck in consequence being also very damp, we lighted the apparatus below for warming the ship. About two in the afternoon I thought there was more smoke than there ought to be, and I went and asked if they had been putting more fuel on, and was told that they had not. Presently after clouds of smoke burst up the hatchway, perfectly stifling. We knew then that something had taken fire, and the tube that only ought to have emitted heat was emitting smoke into all the cabins and got intensely hot, so much so that in the captain's cabin I could not bear my hand near the aperture. I thought that the stove had been so heated as to set fire to the beams—however we got the fire-engine under weigh, and passed water down

and poured it down the smoke funnel; we could hardly work, the clouds of smoke were so dense. After about three hours' hard work we got the fire under, and found that a number of plugs supplied for the Pateraroes which had been stowed in the funnel, and all of which we thought to be out, had taken fire and caused the alarm. It is well we got off as we did, for the ship is so lumbered with combustible matter that any part of the ship taking fire would be attended with serious results.

On the 31st we cast off, and, to our inexpressible delight, on the 2nd February we were in clear water. We had been now since the 23rd December coming 100 miles; do you not call that perseverance? But the season was now so far advanced that we had little hopes of doing anything. This was in Lat. 68° S., and last year we had turned back from 78° on the 11th February, so we thought that we should soon have to turn....

After leaving the ice we again fell in with the pack which trended to the westward, so we kept along the edge of it till we came near our old track of the year before, and in Lat. 77° crossed it. On the 20th February we had a dreadful gale, not from the force of the wind, for that is nothing; but the spray as it broke over us froze when it touched the deck, so that there was not a particle of the ship visible for ice. Between the deadeyes of the lower rigging was a perfect mass, and all overhead gear carried away from the weight of ice which formed in large lumps on it. The worst of this kind of weather is the unmanageable state of the ship, and the men of the watch cannot move to warm themselves, and when a spray comes over them they are literally moving lumps of ice. At midnight we made a pack right ahead. After beating the gear with sticks for half an hour we managed to wear, but the *Erebus* could not till the third time of trial. We thought Captain Ross would have turned back after that, for it was very evident that the winter had set in; but no, it became finer, and to the southward we steered, and on the 23rd, at half past seven in the evening, we reached the highest southern latitude ever reached, being six miles further than we were last year. It was a lovely evening, and the last ten or twelve miles we were sailing through pancake ice—that is, ice of this year's growth.... The *Erebus* sounded, and we tacked in the spot she did, so that neither ship could say she was beyond the other. No one will ever beat that in this longitude, that I may safely say. The barrier was not so high as where we made it last year, but more irregular, and appeared to rise gradually inland (if I may so term it). We steered along it to the northward, and next day we had the rendezvous "Falkland Islands." We steered back along the edge of the pack, and on the 26th passed through a great quantity of very yellow young ice; some of it was bottled off. I did not preserve any, for I have but barely sufficient room for myself without bottled water.

On the 28th, in the afternoon, we got amongst a great number of icebergs (which always congregate at the point of a pack); some of them were several miles in extent, and at one time we counted ninety. Towards evening we found we had got into a regular bay of them, and were obliged to haul close on a wind to clear them. Just before 9 o'clock the *Erebus* weathered a large one

(which was a great object to weather), about a quarter of a mile, and we bein to leeward weathered it also, but within thirty yards; the sea between us an it was like a cauldron of boiling water, and breaking against it with great fury I hardly breathed while we were passing it. The hands were on deck to tack but she would not have gone round. They said in the *Erebus* that it was a ver pretty sight, but more interesting to those that are safe than to those present..

On the 1st March we again saw the pack, and passed round the sharp en of one off which were a great number of seals. This was in Lat. 67½°....On th 7th we passed some seaweed, and of course there were many conjectures as t where it could have come from. We had a slight aurora two or three days We saw no ice on the 10th, 11th or 12th, so we flattered ourselves we wer clear of it altogether, and were steering east for Long. 124°, a spot marked b Major Sabine as the spot of maximum intensity, which we have found incorrect

And now, my dearest Emily, I approach the awful morning of the 13th... On the morning of Saturday, 12th March, the wind was light, but it rapidl increased and by noon it blew very hard, and the evening set in stormy an very thick hazy weather, with a heavy sea running and pitch dark. At mid night we passed what was thought to be an ice-blink (that is a light throw from large masses of ice). On Sunday morning it was my messmate Moore' watch, when he thought he saw an ice-blink ahead and broad on one of ou bows.* We were going nearly eight knots and had just reefed the topsails and we were going to haul up to clear it on the other hand, but the *Ereb* made the signal to keep further off, and we bore away again, closing the blink rapidly. Moore had told the captain, who was on deck at the time, and aske him to haul up without waiting for the *Erebus*, who apparently did not see i and we were just going to do so at 12.50 when the *Erebus* must have seen th ice ahead, but not that which was now well on our beam and which she coul not have weathered, and she could not have tacked in such a heavy sea, an there was no room. She must have run right on the berg, which was now diml visible with a small darkness that looked like a gap or a small opening in i Her destruction would have been inevitable, but Providence, by a dreadfu accident, averted that calamity and saved her, for, as we were both suddenl hauling to the wind on opposite tacks, we came in contact; the *Erebus* strikin this ship heavily on the starboard cathead, breaking our anchor right in tw and taking the cat-head and a part of the anchor away, carrying away flyin jibboom and jibboom, the former of which broke in three places and snappe close off at the cap, and carried away the lower studding-sail boom. He damage was much greater, losing her bowsprit close off at the bows, fore-to mast and main-top-gallant-mast, and the whole of the cat-head and ancho After striking several times very hard she worked further aft, our ancho being cleared. She next struck us near the gangway, she then splintered th immense strengthening pieces outside which prevented our being cut dow Our yard-arms were now striking at every roll, and broke all the booms an boom-irons, which came tumbling down without hurting anyone. She the (working further aft) struck us abreast the mizen-mast several times, smashe

* The port bow is meant.

the quarter boat, broke the ice-plank, and again shattered the strengthening piece outside and tore off all the iron work. We then separated, she carrying away our spanker-boom.

All this time we had been bodily drifting on the bergs, so that when we cleared the *Erebus* we found an enormous iceberg close under our lee. A dreadful shipwreck and death then appeared inevitable; there was no alternative but to run for the dark place we had seen before, which might be an opening, or be smashed on the face of the cliff. The helm was immediately put a-starboard, and with the assistance of the sails she answered it very well. We were immediately rushing past an enormous berg, the ship being perfectly covered with the foam caused by the sea breaking against it. Every moment we were expecting the ship to strike ice right ahead. "Hard-a-port" was screamed out from forward (then indeed hope died within us); "Hard-aport; brace round the head-yards." "Shiver the main-top-sail," cried the Captain, as if he were steering into any harbour. The men flew to the ropes, although I should think at that moment that there was not one on board but thought all hope was fled. She came round, and passed through an opening between two bergs not twice the breadth of the ship, the foam and spray dashing over us on each side as we passed. Several other alarms were given owing to the brash (small stuff washed from the bergs) looking more like bergs in the darkness, but we were safe, but did not know it. The next cry was "Where's the *Erebus*?"—our own danger had made us entirely forget her for the time. All eyes were immediately straining through the gloom to find her. We burnt a blue light, and soon after had the happiness of seeing her burn one which we immediately answered; we knew then that she was safe, which with her losses we never expected. We then lay to, anxiously waiting for daylight to find the extent of her damages. As soon as it could be distinguished she made the signal that: "All was well, and that they could repair all their damages." We answered: "Thank God, we are the same."

And now, my dearest Emily, I must if possible describe my own proceedings and feelings during that eventful hour, for it was not more than that time from our getting foul till we were safe: I was in bed, and on the sick list with my hand. I had been awoke by the noise of reefing topsails, and lay awake listening. I knew something must be wrong, by the constant commands to the helmsman. At last some one regularly screamed out down the fore hatchway, "All hands bear a hand on deck, every one"—and immediately after came a crash. "Good God," cried I, "we are foul of an iceberg." I opened my door, to prevent its being jammed, and hurriedly put on two or three articles of dress and jumped up the hatchway, fully expecting to see the cliff of an iceberg over our heads, instead of which, just abreast the gangway were the bows of the *Erebus*, on top of a sea, as far as the copper above our gunwale, her fore-top-mast and bowsprit gone. Down she came crash, with a shock that nearly knocked me down; our men had all rushed up half naked and were perfectly bewildered. Nothing could be done more than we had, which was to set the fore-sail and brace the headyards up. Crash, crash, again and again as she worked aft. I had gone under the ice-plank, as I expected every moment

to see her fore-mast come on board of us, which would have taken our mizzen mast in its fall, and I had more protection under a heavy piece of wood than on the open deck, but, thanks be to God, a belly-stay (an extra stay to the fore-mast independent of the bowsprit) held it. Up she would stand; "Clear the ice-plank," cried a dozen voices; down she came, crash went the ice-plank at the same time the boat was cut in two as with an immense hatchet. "Thank God, she is clear," cried I, as she passed under our stern, snapping our spanker boom in two as if it had been a straw.

But my joy was of short continuance, for no sooner were we clear of the *Erebus* than we had this immense berg under our lee, and so close that we already appeared to be in the foam.... The Captain himself, when it was all over, said that he had not the slightest idea what he did during the time or how we got through. The men on the whole behaved very well throughout; only one was running about out of his senses, but two or three were crying. It was truly the time when "shrieked the timid and stood still the brave." I looked round me when the first blue light was burnt, and, to see the ghastly appearance of everyone's face, in which horror and despair were pictured, the half-naked forms of the men thrown out by the strong light, oh! it was horrible, truly horrible....

You may imagine the force with which the *Erebus* struck us when I tell you that her spare anchor in the act of falling must have come in collision with our side, which drove the palms of it right into her through copper and all; that in this way she conveyed it 800 miles, when it must have worked out...

Falkland Islands. Here we are, safe and not sound, but all in good health thank God. We arrived here on the 6th, having been 135 days at sea, and 133 without once seeing land. It was the anniversary of our arrival at Hobarton last year, and in one way in the same state, that is, we had not one on the sick list, and the *Erebus* only one. But the ships, how different! We both of us look perfectly shattered. All I have written concerning the *Erebus* is correct with the exception that she did not lose her main-top-gallant mast, but we cut her gunwale down to the deck, and the anchor that was drove into her side broke and left a large piece in. They describe the scene much the same as I have done; they gave themselves over, and say that when we cleared them we appeared to bound forward to what they thought certain destruction. We disappeared suddenly, and they did not believe the gap was an opening between two bergs, but merely an indentation in one. They, after parting, set the main sail and backed the yard (the fore-sail was split and unmanageable owing to the top-mast lying across it). They then backed close to one berg (the sea breaking right over her), and when close to it filled and went through the same opening.

"Franklin Island. January 27, 1841. Lat. 76° 8′ S., long. 168° 12′ E."
Six watercolours by J. E. Davies, painted during British Antarctic Expedi

(*Facing p.* 596)

"Possession Island, Victoria Land. January 11, 1842. Lat. 71° 56′ S., long. 171° 7′ E."

"Cape Davis. Lat. 70° 32′ S., long. 166° 6′ E."

Extracts from C. J. Sullivan's narrative:

Written by C. J. Sullivan

For

James Savage Sailor on board

H.M.S. *Erebus*
Rio de Janeiro

June 19th/43.

My friend James before i begin to give you anything Like a correct acc't of our Dangers and discoveries, it is but justice to this my first voyage to the South, to give you an acc't of our Discoveries, before you joined the Expedition—this is the most Sublime But not the most dangerous.

The Expedition Left England on 30th of Sept. 1839—

On the forth of October we Lost Sight of old England, calling at the Caneries. St. Helena Cape of Good Hope Van Deimans Land

on the /9th of Decbr we Faced the antarctic Ocean.

Janry. the 11th [1841] at two oclock on Monday Morning, we discovered Victoria Land the Morning was beautiful and clear.

at 7 oclock in the afternoon we were under the Lee of the land, Sounded in 250 fathoms of water—not a cloud to be seen in the firmament but what Lingered on the mountains—Large floating Islands of ice in all directions Hills vallies and Low Land all covered with snow. The Snow top'd mountains. Majestically rising above the clouds. The Pinguins Gamboling in the water the reflection of the sun and the brilliancy of the firmament Made the rare light an interesting view....

That night we stood out from the land, we did not loose sight of it for the Sun was high above the horizon at midnight as it would be in England on a Christmas day.

While we were in these distant Regions we had no night. I mean Dark.

12th Do. Captn. Ross went on Shore he took possession of the land without opposition. In the name of Queen Victoria—hoisted the British colours gave the Boats Crew an allowance of Grog with three hearty cheers for Old England. The species of Pinguins amphibious Little Creatures we[re] so thick the Captn. could not enumerate them. But the beach was literally covered with them....

At 12 oclock the Captain Come on Board we made all Sail Running by the Land to the Eastward Blowing very hard and Still Keeping out to Sea to avoid Danger.

On the 13th we made Mount Sabrina* here is a Phenomena. This splendid mountain Rising Gradually from the Sea Shore to the Enormous height of Sixteen thousand Eight hundred and ninety feet high. I could compare it to nothing Else but the Spier of a Church drawn out to a regular taper point. Protruding through the Clouds. But beyond this as far as the Eyes Could Carry the object Seemed more Interesting.

[* Mount Sabine, 11,883 ft. high.]

My friend if i could only view and Steady the Sublimity of nature—but Lo i had to pull the brails. This noble battery of Ice that fortifyd. the Land two hundred feet high and floating islands in all directions this Strange Scenery was Remarkably Striking and Grand. The bold masses of Ice that walld. in the Land Rendered this Scene Quite Enchanting. This mountain is most perpendicular mountain in the world—we have Seen it at night a hundred and fifty miles Distant. We Shapd. our Coarce a Long the land to the South East a Distance of two hundred miles farther. On the 28th we discoverd. Mount Erebus* this Splendid Burning mountain was truly an imposing Sight. The height of this mountain Six thousand feet hight with a gradual ascent from the Sea Shore. From the Summit of this mountain issues Continually Vast Clouds of Smoke when Scatterd. about with the wind forms a Cloudy Surface of Smoke a long the Surface of the mountain.

At the west End of Mount Erebus it plainly appears there has been a Desperate Eruption from the Craggy appearance—it is Sufficient to Convince an acute observer.

The south side of this Splendid mountain was Lost to our view, Land and Ice obstructed the Scene. We did not land here nor did we deem it Safe to Land neither; we could not see fire nor matter, the Sun Shone so brilliant on the Ice and Snow it completely Dazled our Eyes. Yet it is my firm belief that this must be an imposing sight in the dark of winter. Our nearest approach to this Phenomena of nature was Eight miles. This was not our last visit to Mount Erebus—after returning from the Southern Barrier we remained twenty four hours in the neighbourhood of this Splendid mountain. The Magnetic Pole was only Forty five miles in Land from Mount Erebus but inaccessible to the human Power.

A Description of the Great Antarctic Barrier Latitude 75 South. At the South East end of Mount Erebus and joining the Main Land of Victoria continent begins the Barrier or as I should call it natures handy work, in the evening we commenced runing thinking from the Declination of the Barrie from the distant view from the Mast head that we may run it down by midnight. But as far and as fast as we run the Barrier apprd. the Same Shape and form as it did when we left the mountain. We pursued a South Easterly Cource for the distance of three hundred miles But the Barrier appeared the Same as when we Left the Land. On the first of Febry we stood away from the Barrier for five or six days and came up to it again farther East, on the morning of the Eight Do we found our Selves Enclosed in a beautiful bay of the barrier All hands when they Came on Deck to view this the most rare and magnificent Sight that Ever the human Eye witnessd. Since the world was created actually Stood Motionless for Several Seconds before he could Speak to the next man to him.

Beholding with Silent Surprize the great and wonderful works of nature in this position we had an opportunity to discern the barrier in its Splendid position. Then i wished i was an artist or a draughtsman instead of a blacksmith and armourer...We Set a Side all thoughts of mount Erebus and Victoria

[* 13,350 ft. high.]

Land to bear in mind the more Immaginative thoughts of this rare Phenomena that was lost to human view.

In Gone by Ages.

When Captain Ross Came on deck he was Equally Surprizd to See the Beautiful Sight. Though being in the north Arctic Regions one half his life he never see any ice in Arctic Seas to be Compard. to the Barrier. So that the South Pole must be degrees colder than the North pole is evident from the Enormous thickness of the ice. An Ice island floats on the water with 7/8 under water. Consequently the ice islands we have Seen two hundred feet high above the Surface of the water must be Sixteen Hundred feet high. That is exactly four times higher than the Cross of St Pauls Cathedral in London. To view an ice berg when the Sun shines clear on it for any time is very injurious to the Eyes for the Avalanches in the Ice presents a deep blue and greenish hue. From a concussion of air. that generally casts a dimness on the Sight and leaves the object the greatest Source of wonder and admiration. It would take A man of Talents to describe this unequal Sight. For no imaginative Power can convey an adequate idea of the Resplendant Sublimity of the Antarctic Ice wall. It is quite certain and out of Doubt that from the seventy eight Degree to pole must be one Solid continent of Ice and Snow. The Fragments as i call the floating Islands though Large Enough to build London on their Summit must through a Long Succession of years have parted from the Barrier they could never accumulate to Such an Enormous hight otherwise. Some bergs from one mile Sqre to ten miles and Some Larger but i could not ascertain the Sqre of them.

On the ninth of Febry the Captn. thought proper as the sun was getting low on the horizon and indicated the Quick approach of winter to retire to our Quarters in Van Deimans Land. On our return from the Barrier we Steered for the land the yankeys Reported in 70th Degree South.* We were three days Sailing a hundred miles each way Sounded in 500 fathoms of water in the centre of Yankey Island but Low it disappeard. The Fable the Americans told about their great Discoveries of this Land they Said they Saw it thirty miles ahead but could not reach it in consequence of the Ice being so thick.

I will endeavour to clear up this Problem. In these high Latitudes at the close of the Summer the Clouds appears very heavy in the horizon Sometimes in a heavy cluster So that the Pharhelion Sun reflects on Some of the clouds at the horizon they appear very much like land we were frequently mistaken ourselves. But we were never impatient to Log down Land till certainty proved the fact. Here i will leave the yankeys and french after their Long voyages from their native countries and the little progress they made at the Southward. The French† returned to Van Deiman's Land in a miserable they had lost a great number of their Crews with the Scurvey While Fortune Favoured the English Expedition. After we Left the supposed Americans

[* This is a reference to the United States Exploring Expedition, 1838–42, leader Charles Wilkes.

† A reference to the French expedition of 1837–40, leader J.-S. C. Dumont d'Urville.]

Land we Steered direct for Hobartown with a fair wind we Cast Anchor at ou Observatories in the Derwent River on the 7th April 1841.

The Governor Sir John Franklin and the inhabitants of Hobart Tow welcomed us all hands were in Good health and Spirits, Fresh grub, Liberty on Shore with a drop of the Creator—Soon made our Jolly Tars forget th Cold fingers in the Frozen Regions...for very Little they thought of 78 Soutl while Regealing them Selves at Charley Probins the Sign of the Gordon

Castle Hobart town
Van Deimans Land.

June 1841.

Pray excuse the mistakes for the confusion is to much around me.

C. J. Sullivan

I joined H.M.S. Discovery Ships Captn. Ross in the discovy of the Antarcti Seas. We sailed from Hobart Town for Sidney we remained three weeks an made Sail for New Zealand. At the Bay of Islands we remained three months The Natives we found to be very affectionate.

On the 23rd of November we weighed anchor. For the Antarctic Region to call at Chattam Island The weather was two thick and we rather close t land Besides blowing fresh we Sailed past it. That Left us without Murpheys* for the South.

Decbr. 16th I saw the first ice Berg i ever Saw in my life no Small Sigh 150 feet above the level of the Sea a Splendid Sight to behold. In Latitud 59 South.

17th Icebergs in all Directions. Light Favourable Breezes with Snov Showers.

18th the first light all day and night no Dark.

19th at 4 oclock p.m. run into the Slack fields of ice cracking through th ice for the distance of thirty or forty miles the ice Still Getting thicker. H intended to Return but he could not for the ice closed on us behind.

Sunday the 20th the ice getting heavier Drifting with the Currant we coul make no way.

Monday 21st hazy thick weather a.m. we come up close to an ice berg To compare any Sight Ever my Eyes beheld to this magnificent ice islan one mile sqre as if the hands of man prepared it with Splendid mouldings Cornices, porticoes, Towers and Colums all natural architecture how wonde ful is the works of nature.

This day the Captains sounded with the Large Cast Iron Hook in 170 fathoms.

22nd the ship was caught between two bergs the Terror run half over on Latitude 66 south.

23rd anchored to an ice berg all hands to water ship.

[* Potatoes.]

24th. No passage. We were compelled to propel the ship with hausers for very large climpers* Bearing down on us. Gained a Little pond.

25th Christmas day we had a Comfortable dinner with our Harness on propelling Ship.

31st the ice completely Shut us up. At 6 p.m. we Cast out Double Anchors one over the bows one a stern. The Terror at the other side of the berg here was a Game in the Antarctic Seas. A public house Erected on the berg with all Kind of Games. A grazy tailed pig. Climbing a grazy pole. Jumping in a bag.

1842 Janry 1st.

The Terrors Crew Came on board we Kept up Danceing until 5 oclock in the morning When it Ended with three or four Pugilastic matches in the Forecastle which peacably Ended. All that day the Boatswain and Crews were preparing a ball room clearing away the snow to erect a Public house which was complated by noon adjoining the Bar of the Tavern there was a circus for Different Kind of Games. Out side the ballroom was moulded in ice a Statue of H.M. and Prince Albert. The sign of the Public House was The Pilgrim of the Ocean. At the reverse Side of the Board The Pioneers of Science.

Leading from the ball room to the Coffee room was placed the Alphabitical Colours of 1842.† At the grand Entrance was the union Jack that was hoisted at the north Magnetic pole, When Sir John Ross discoverd. it.‡ The Ensigns [were] hoisted a few yards apart from the ball Room. We fired thirty rounds as the Captains and officers Enterd the Tavern. They Gave three cheers, Drank H.M. health and Spliced the Main Brace for the Crew.

The Games went off well the Exhibition in the circus far Exceeded the Waltzing in the Ball room. James Savage carried the prize in the Bag. Jatter Welsh half strangled the pig and Bandy Carried the prize for the pole. When the Essence of the Barley heated our Gents the Snow Balls went flying. After a round of coffee, they withdrew from this Rare Scene of mirth. So that the Tavern Tap and ball Room, half Empty bottles, in fact the whole ice berg belonged to our Jolly Tars until morning.

To commemorate our stay at this remarkable ice Berg, The Captn. Left a cask with the purticulars of Our Festivities Enclosed in the Cask....

4th it blew very fresh from the Southward.

5th the ice opening from the northward.

6th Cast Loose from our ice berg. Kept dodging about and making fast Several times until at 5 p.m. it came on very Foggy. Both ships were fast to an iceberg. Drifting down on a floating Island. Could not See with the Dense fog untill we were within a few yards of it. All hands were Called to Make Sail. The Surf was runing high at this time, if we were 5 minutes later the Ships would Strike On this berg. We crouded on all Sail On both Ships, Draging

[* Icebergs.

† These would be twenty-six alphabetical flags used in signalling and combined to make a code.

‡ Sir James Clark Ross reached the north magnetic pole on 1 June 1831 during his expedition of 1829–33.]

along with us the ice berg we were fast to, at a Snails pace and cleared thank God.

The Great Storm in the Packed ice Latitude 67 South. On the evening o the 18th Sprung up a Strong wind. By Midnight it blew a perfect hurricane the Sea runing high but breaking. We were in an awful position the Ships dashed from berg to berg, we were in Ememinent danger with the Ships Broad Side to the wind. Every Crash treatning to Shake her timbers to pieces we Expected to see the masts fall over board Every moment.

It was awfully grand two grand for Stout hearted Sailors on this dreadfu night. I am certain our weather beaten mariners were never before moved to danger without the least hopes of rescue if our Ships were wrecked, but the Almighty God was with us in those desolate Regions of moving Mountains I not being bread to the Sea what i have heard and Read concerning the maratine Life presented no adequate idea of those Sublime Effects which the rageing of the Elements produced. The wind has not the Same Effect in the frozen Latitudes that it has on the open Sea. The waves are Short and broken here they are Long and Quick from the Enormeous body of ice the water is forced to Sustain....

To give you an adequate idea upon a small Scale. I could compare it to nothing but to a Steem Engine in a large factory that Sets all the machinary in motion A very feint contrast but it is an idea for the Judges of Locomotive power when there was a large berg it could not mount the waves Equal to the Smaller ones. When at the top of the wave the Sea would leave it of a Sudden then it would Sink into an abyss beneath the Sea again would cover it but when Mounting the Second Sea it was truly terific.

19th the Storm abated the Sea runing high.

20th the ice Closed on us the wind Shifted to the Southward.

21 we Cast anchors again to repair the damages in the best manner we could the Terrors Rudder was Literally Split to atoms. Our Rudder was Split in two and otherwise damaged. We got the blacksmith and Carpenters to work at both Rudders, we got them repaired by the 22nd and Shiped. The ice Still thick and heavy untill the 2nd of Febry it cleared up all of a Sudden at Eight oclock p.m. not a bit of Slack ice to be Seen. Thank God and British Built Ships we See Our Selves Once more in the boosom of the open Sea After being closed up in the center of our Enemy for the space of 47 Days.

After Getting Clear of the ice we made a straight cource for the South until Wednesday 23rd we came up Close to the Barrier Some hundreds of miles farther East and Seven miles farther South. No more hopes this Season. We returned for the Faulkland Islands, South America, there to remain until the next Season. We had Fine Steady Breeze untill we met with Accidence on the 13th of March.

Our Miraculous Escape from Awful Shipwreck

Sunday Morning March 13th 1842 we Escaped through Providence one of the most frightful cases of Ship Wreckd. that Ever occured on the high Seas At one oclock a.m. we were in Company with the Terror. She was runing into One ice Island and we in another under Close Reefed top Sails.

It was blowing a gale of wind at this time the watch was on the fore yard takeing in the last Reef the night was Exceedingly dark we Could Scarcely See a hundred yards off. When Low we were Runing into a Cluster of Ice slands at the rate of 7 Knots per hour. Poor James Angelie Since Drowned Cried out from the foreyard an Iceberg ahead.

The Mournful Cry on deck was General all hands all hands Soon Brought our naked tars on Deck. Before they Could all get on Deck Both Ships Struck with Such force we thought all was over.

When we reached the Deck the Awful Catastrophe presented to our View. Shocking to Relate, the Terror to Avoid instant danger put her helm hard a port, we put our helm hard a Starboard. All this Occurred in the Space of one minute the Terror had more way And Canvas than we had. The Terror was trying to Gow to Leeward of the Erebus but the ice berg would not moove out of the way. The officers in command was Actually Stupefied what to do at this perilous moment they did not know. For if they hit against the berg they would Certainly be lost to avoid Either the berg or the Eerebus was impossible.

Now the dreadful and memorable Scene took place. After the first Stroke a heavy sea Elevated the Terror with our Bow Sprit Entangled a Cross her bows. The bow Sprit was Snaped to atoms, Fore top mast soon followd. fore top mast booms yards stays and every gear connected with the Ships fore castle was torn away. At this time we expected the Terror would sink but she rose the victor to despute the conquest. From this time out we were the sufferers the bow sprit carrying away Saved our lives. Five minutes longer would do the job but God decreed it not.

The Terror was at this time next the ice berg crackling along. She broke away our bower anchor And with the Elevating Sea the Terror was inclining towards us. But before the anchor Could get clear Both Ships Struck with Such force as to bury the anchor in our Starboard Side. We carried it for the Distance of 700 miles through a heavy sea. Such my friend must be the Effect So terrible a Collision a weighty stroke 4000 tons. My friend the next wave Lifted the Terror above our Main Top mast.

The most awful and Tremendous Sight we See yet at this moment, we poor pilgrims of the Ocean thought it was our last in this Life. Some uttered a feint Shriek through instant Surprize. But the Almighty God helped our Sinking Spirits when we though we would have a Dreadful Stroke from her. Like a Shot from a gun She made a leep a Stern and the next Sea carried her Quite Clear of us.

If both Ships was forty Seconds Longer in contact They would Gow down together and no Person would live to tell the tale but God decreed our Separation.

When Terror had Got clear of us then we had another Great danger to Encounter we were no more than Eight yards from the iceberg. Tremendous Sight to See we could not distinctly discern the top of the berg. But a bluff projecting Summit far above our masthead. A heavy Sea pitched us against it. At this Thomas Abernethy the Gunner was on the ice plank he Cried out

a Loud Back the main yard. It was instantly done, the Ship heeled a littl the wind caught the main top Sail and with the draw Back of a heavy Ebbin Sea with Gods help we Got clear off with every succeeding wave. After Little time we Discovered we were in a cluster of ice islands. To help ou Revived Spirits The Carpenter announced the pumps to be free and clea all went on well, by this time began to bestow a thought on the Terror. Fo actually we thought when she Leaped astern in her confusion and She havin a Deal of sail on that She hit Some of the bergs and went down. Our Consort Crew were more alarmed about our fate. For they thought we were Gone an no Certainty of Escape. But Stop a Little before day Light we hoisted a blu Light. Immediately the Terror answered. Judge my Friends our Feelings a Both Sides. God almighty, My friends, alone that Saved us from a miserabl death 3000 miles from any land.

At Four oclock the day began to dawn the happiest Sight we any of u ever welcomed its now with open day Light we Could See the Eminent an awful Danger we were placed in a Little before. With a good resolution a hands Set to work to clear away the Wreck, the Sun Shone Beautiful, th day was calm but the Sea run high we had fine weather for a week Thursda Evening we had a jury bow Sprit rigged. Fore top and Gallant masts an yards and all the Wreck well Supplied for rounding the Tempestuous Cap horn. We Lost a man rounding the horn in the gale of wind and on the 6th o April we Cast Anchor at Port Louis, Barkleys Sound,* Faulkland island South America. If our Ships were Merchantmen this Scribbled Descriptio i give of our Miraculous Escape would never reach Great Britain. But thank to our noble Strong Barks they done their duty....

[* Port Louis, Berkeley Sound, was the seat of government until 1844 when Port Stanle was founded.]

RESTORATION OF THE SCOTT AND SHACKLETON HUTS ON ROSS ISLAND, 1960–61

BY L. B. QUARTERMAIN*

[*MS. received 2 May 1961.*]

New Zealanders interested in Antarctic exploration have for some years been concerned about the condition of the old huts in McMurdo Sound, built and occupied by the expeditions of the "heroic age", and during the past two or three years sporadic attempts have been made to tidy up Shackleton's hut at Cape Royds and Scott's hut at Cape Evans. Working parties from H.M.N.Z.S. *Endeavour* and men from "Scott Base" have done urgent repair work and a certain amount of cleaning up, but it was evident that a more extensive project, properly organized and supervised, was necessary if the huts were to be made readily accessible to interested visitors and restored to a condition more in keeping with their historical interest.

The Antarctic Division, New Zealand Department of Scientific and Industrial Research, therefore instructed Athol Roberts, Public Relations Officer at "Scott Base" during the 1959–60 summer, to report on the condition of the huts and the extent of the necessary renovations. The Antarctic Division convened a meeting of representatives of the New Zealand Historic Places Trust, the Royal New Zealand Navy, the Ministry of Works, the New Zealand Antarctic Society, the Ross Dependency Research Committee and the Dominion Museum. This resulted in a restoration project which was approved by the Government and initiated during the Antarctic summer of 1960–61.

It was agreed that the aim should be to restore the huts to their original appearance and to preserve them from further damage; only essential construction work was envisaged, and it was not desired to give the huts the appearance of museums. The question of the restoration of Scott's hut at Hut Point was postponed pending a more careful examination.

The writer led the restoration party, and during 1960 made enquiries of overseas experts as to the best method of retrieving and conserving delicate articles long encased in ice. Photographs of the huts by early expedition members, by Americans who visited the hut areas in 1948, and by men who examined the huts during the IGY period, were assembled. Descriptions of the huts were collected and photocopied for easy reference during the project, and an extensive correspondence was maintained with men who had lived in them.

The Council of the New Zealand Antarctic Society readily accepted an invitation for three of its members to give some time without remuneration to the project, and from sixteen well-qualified applicants, E. R. Gibbs,

* Information Officer, Antarctic Division, New Zealand Department of Scientific and Industrial Research: Editor, *Antarctic*.

M. M. Prebble and C. G. Wilson were selected. As the time these men coul afford was necessarily limited, two men who had wintered at "Scott Base during 1960, J. Buckley and A. Jenness, volunteered to work on the projec until the Antarctic Society men arrived. Finally, a very experienced builde J. McK. Sandman, was appointed as "construction chief".

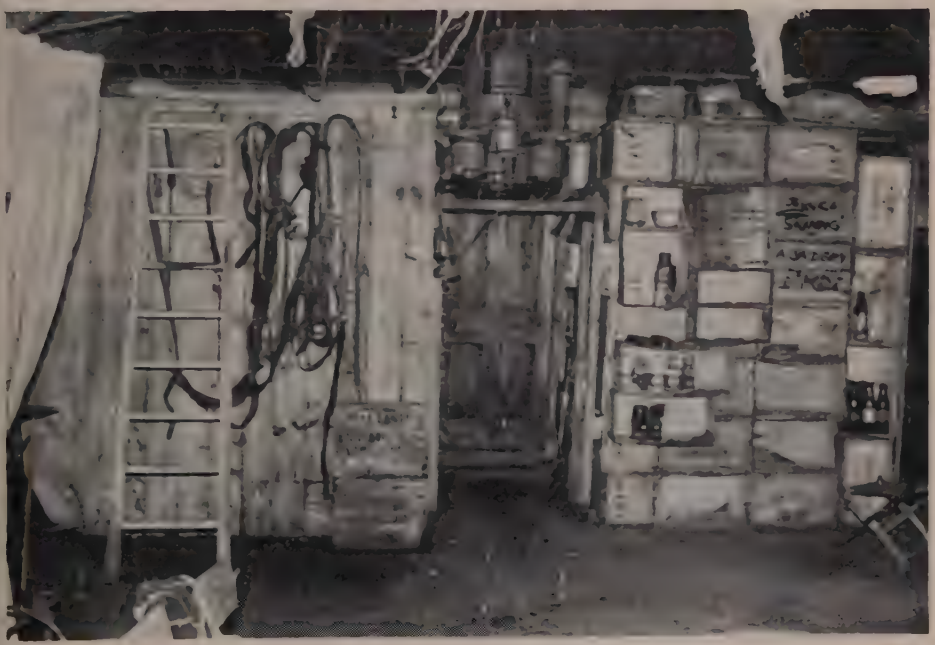
The United States authorities showed great interest and willingly provide transport by sea or air between New Zealand and "NAF McMurdo", as we as helicopter transport between "Scott Base" and the huts.

Work began when Quartermain, Sandman, Buckley and Jenness arrive at Cape Evans on 5 December 1960. Though the hut itself is structurall sound, snow had entered through broken windows and openings in the roof durin the 44 years since its last occupation, and it was two thirds full of compacte snow, with a layer of from 2 to 8ft. of solid ice on the floor. Only the entrance, c "galley" end, part of the "mess deck", of Scott's day, was relatively free of ic and even here there was a good foot of hard ice over the whole floor.

The last men to occupy the hut were the seven survivors of the Ross Se component of Shackleton's Trans-Antarctic Expedition, rescued in Januar 1917. This unfortunate party, at first ten strong, was stranded when *Auror* was blown out to sea in May 1915, and had to subsist as best they could o what they found in the huts at Cape Evans and Cape Royds. As they had n fuel but seal-blubber, the hut was soon filthy with blubber soot, and th struggle to survive left the weakening men little time or energy to keep th hut tidy. So excavation of the big, 50 ft. long hut with pick and shovel wa a dirty as well as a hard task, but by Christmas the team had almost cleare the accumulated snow and ice. Sandman estimated that 250 cu. yd. of ice wer dug out. The useless rubbish was drawn by sledge to the fast ice, where either went down a tide crack or disappeared when the ice broke out som weeks later.

After Christmas, the re-organized party (the Antarctic Society men havin replaced the pair who had wintered over) was flown to Cape Royds, the sit of Shackleton's hut in 1908–09. This much smaller hut was practically free c ice, but untidy inside and out, with a thick layer of seal blubber on the floo at the stove end. The main task here, therefore, was spring-cleaning. Obviousl useless rubbish was burnt, while spare foodstuffs and other objects wer carefully stock-piled and listed. The hut was practically a shell but the origin canvas partitions may eventually be restored. A careful selection and distr bution of the material found inside and outside made it possible to re-creat something of the original atmosphere. Shackleton fed his men well, and ov 120 varieties of tinned and bottled foods were found in or about the hu Windows and doors were replaced or carefully repaired, the roof was covere with tarpaulins, battened down in the original pattern and given two coats unobtrusive paint. The pony stable was cleared out and built up, and relevan relics such as harness, food bins and a nose-bag placed in it. The garage wall of cases, rose again and what remained of the Arrol Johnston motor car wa replaced in its original home. Finally, the surroundings were thorough cleaned up before the party was flown back to Cape Evans on 17 January.

Marshall's cubicle with Shackleton's on right



Porch end after restoration. Shackleton's cubicle on left, darkroom on right

Interior of the hut at Cape Royds, British Antarctic (*Nimrod*) Expedition, 1907–09

Photographs: R. J. Buckley

(*Facing p.* 606)

Laboratory after restoration

The wardroom after restoration. Scott's cubicle behind partition on left; darkroom door behind table

Interior of the hut at Cape Evans. British Antarctic (*Terra Nova*) Expedition, 1910–

Photographs: L. B. Quarterma

Here there was still a great deal of work to be done as temporary repair work was replaced by something more permanent. Here too the roof was covered and all windows and doors made secure and weather-proof. Working on the roof was, at times, a cold job, but advantage was taken of every reasonably fine day and long hours were worked, especially by Sandman and the younger men. As leader, I cannot speak too highly of their hard work and informed enthusiasm for the task.

It was relatively easy, despite the fact that it was nearly filled with ice, to restore the Cape Evans hut to a lived-in appearance, as the well-known bunks erected by the officers and scientists of Scott's party were, if not intact, at least recognizable. Before the New Zealanders left, the big hut was looking structurally very much as it must have looked fifty years ago. The only actual re-construction done was to re-build Oates's bunk which, always an insecure one, had completely disintegrated. Old photographs made it possible to do this re-building accurately and the home of the "Bunderlog" now faces across to the "Ubdugs" just as described by Griffith Taylor, Cherry-Garrard and Evans in their books.

The original chairs, at least a good many of them, are in place round the long ward-room table. Tom Clissold's galley, not so spick and span as he no doubt kept it, is still well-stocked with foodstuffs as well as pots and pans. There is a tin of "Truegg" there to recall an incident recorded by Evans in ch. VIII of *South with Scott*. At the other end, on the laboratory shelves and tables, are innumerable bottles and jars and pieces of scientific apparatus. Though the bottles had to be picked out of hard ice, many still contain the original chemicals, but not many of the labels have survived.

On Debenham's little table, the oilcloth survives, and underneath his bunk are boxes containing rock specimens carefully labelled in orange paint. Across the way, the restored Oates bunk is again festooned with pony harness and pony snow-shoes. And in Wilson's cold corner, where it was found, is an Emperor Penguin perfectly preserved.

Unfortunately it was not possible to restore the clothing of Scott's day. Whatever garments were left in the hut had perforce to be used by the 1915–17 party while there was any wear left in them, and the hard-pressed survivors had to make their own. The clothing dug out consisted either of soot-soiled, torn and patched original garments, or home-made footwear and gloves fashioned from sleeping-bags, old canvas or seal skins; of such there was an abundance, pathetic testimony to a grim experience. It is these garments which are spread about the bunks along with the innumerable little things that were somehow left behind—reels of cotton, packets of pins, scissors, ditty bags, rolls of cotton-wool and bandages (in the Dr Wilson area), a hektograph tin with ink, a home-made bagatelle board with cue and balls, a few pictures, a pipe, ink bottles and pens....

Something like 50 books and magazines were retrieved from the ice and carefully dried out; most of them had apparently been brought round from Cape Royds. There were English and New Zealand magazines and newspapers mostly dated about 1906–07, and the books ranged from the paper-backs of

the day to scientific and medical tomes, and included the Geological and Zoological reports of the *Discovery* expedition. It is significant of the spirit with which the 1915–17 survivors faced isolation and privation that at the head of Richards's bunk, completely encased in ice, was a copy of *Nature*.

Among the more interesting discoveries were a black notebook containing meteorological observations of the 1915–17 period, a diary, presumably Richards's, describing a 1915 sledge-journey with Ninnis and Hooke, and, pinned to the dark-room door, a typed letter signed by Captain J. K. Davis recording the relief of the stranded men in January 1917. Under the pillow of the bunk occupied in 1911–12 by Bowers and in 1915–17 by Joyce was found, on a leaf torn from a note-book, a letter signed "Aspley Cherry-Garrard" and obviously addressed to Captain Scott. This was the note left by Cherry-Garrard at Corner Camp on 16 March 1912 (not 19 March as Joyce says in *The South Polar Trail*) when he was about to return to Hut Point after his sledge journey with Dimitri in support of Scott's southern party. Scott was at this time very near his end some hundred miles to the south.

The opening of Ponting's darkroom (and bedroom) door revealed an area beautifully festooned with long icicles and delicate ice-crystals, but otherwise almost free of ice and snow. It was very much as Ponting must have left it, well stocked with photographic chemicals and apparatus, including a film-dryer and a tripod. No photographs of Antarctic interest were found here, but a set of lantern slides was probably used by Ponting in one of his lantern lectures. In a rubbish box outside were a few developed plates and films, apparently of the 1915–17 period, as one showed Stevens examining a meteorological screen.

The restoration party returned to "Scott Base" in February 1961, leaving both huts completely cleared, except for the stable at Cape Evans, and tidy and weatherproof.

It is confidently expected that the huts will now admit very little snow and an annual clean up by a few men from "Scott Base" should serve to maintain them in a satisfactory condition. It is recognized that it may be difficult to prevent a certain amount of pilfering. It is clearly impracticable to "police" the huts and no one wants to shut them up so that they cannot be seen, or used by men in need of shelter. The writer believes that even men who would unblushingly "acquire" desirable relics left lying about on something resembling a rubbish heap, will hesitate to purloin souvenirs from an obviously preserved building. It is proposed to produce an illustrated booklet describing the huts, telling their story and pointing out the significance of the more interesting articles to be seen in them.

A plaque recording the date of erection and the expedition or expeditions which used each hut has been placed on the outer wall near the entrance; a scroll outlining the principal events in the hut's history has been placed inside. The scrolls were prepared and presented by the New Zealand Antarctic Society.

SOVIET TERMS FOR THE NORTH OF THE USSR

BY T. E. ARMSTRONG*

[*MS. received 10 January 1961.*]

There has for long been discussion among Soviet geographers[1, 2, 3] on the definition of various terms in Soviet usage to indicate the northern part of the USSR. Some of these terms—"the Arctic" [*Arktika*], "the Arctic region" [*arkticheskaya oblast'*], "the sub-Arctic" [*subarktika*], "the polar regions" [*Zapolyar'ye*]—are normally used to denote areas defined according to physical criteria. Such criteria are similar to those usually applied outside the USSR, such as the "10° C. July isotherm", the "tree line", or the "limit of continuous permafrost", and, again as in the non-Soviet world, the terms have no generally accepted precise meaning and must be defined by each user. But in addition to these terms for natural regions, there are certain terms in predominantly economic and administrative usage: "the north" [*sever*], "the far north" [*dal'niy sever*], "the extreme north" [*krayniy sever*], "the northern marches" [*severnyye okrainy*], and "the Soviet north" [*sovetskiy sever*]. Some explanation of their current connotations may be helpful to those studying Soviet literature.

The first two may be quickly dismissed. "The north", a pre-revolutionary term still in quite frequent use, has always referred in a more or less vague way to the north of European Russia (i.e. west of Ural). It is to be found in a recent statistical handbook,[4] where it is defined as Vologodskaya Oblast', Arkhangel'skaya Oblast' and Komi A.S.S.R. "The far north" was used by Lenin in a restricted sense in connexion with Arkhangel'skaya Guberniya, but has been little used since.

"The extreme north" and "the northern marches" are virtually synonymous, and are the terms used in legislation. Either may have "of the USSR" or "of the RSFSR" added to it. A number of laws have employed them since 1924, and in some cases a schedule of the administrative areas designated is appended to the law. These schedules do not all coincide. This is partly because the administrative districts of the USSR are continually changing either in name or in actual boundary. In addition, no law lays down that for all purposes a given part of the country shall be called "the extreme north"; each is concerned with legislation on a particular topic. As Sergeyev[3] points out, the fact that the law outlining arrangements for the 1939 census omitted from its schedule of "the extreme north" certain regions normally included should not be taken as meaning that those regions are no longer part of "the extreme north", but rather that for the particular purpose in mind they required different treatment.

Because the earliest legislation about the north was concerned with the

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native peoples, the area connoted by the term "the extreme north" was originally the area where these peoples lived. There was already agreement as to which peoples should be regarded as comprising this group, known as "the small peoples of the north", and their territory reached as far south as the mouth of the Amur and Sakhalin. This partly explains why "the extreme north" reaches south of lat. 50° N. But, although ethnic considerations were the most important factor in determining the extent of "the extreme north", the grouping does accord also with certain other criteria associated with human problems, such as remoteness and underdevelopment.

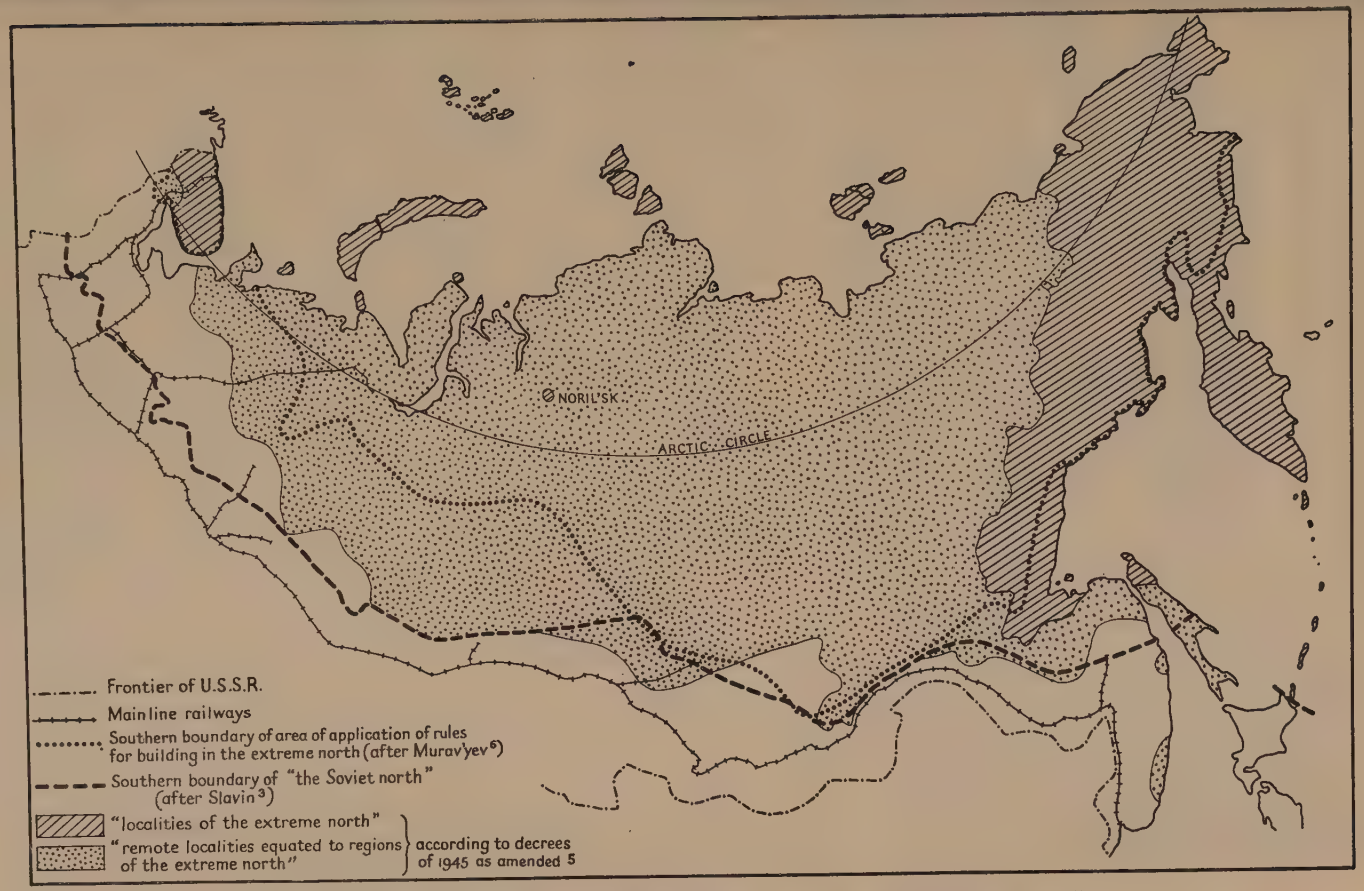
The most recent legislation to include a schedule of administrative regions belonging to "the extreme north" is a group of decrees of 1 August, 2 September and 18 November 1945[5] on privileges for workers in the extreme north and remote areas. These decrees in fact provide two lists, one of "localities of the extreme north", where certain stated privileges are granted, the other of "remote localities equated with regions of the extreme north", where lesser privileges are granted. The area covered by both these lists is shown approximately on the map (exact plotting of the southern boundary has not everywhere been possible owing to the difficulty of finding Soviet maps showing *rayon* boundaries). It will be observed that "the extreme north" proper is very curiously distributed, no doubt for particular reasons associated with labour problems. The "remote localities equated with the extreme north", however, fill out the area to something fairly closely resembling the schedules in earlier legislation. The two areas taken together very likely make up "the extreme north" of the statistical tables,[4] but it has not been possible to obtain confirmation of this. Together, they comprise about half the total area of the country. Their extent is not stable, even in this particular legal application, for between 1945 and 1956 both areas were enlarged by the addition of further administrative districts. The complete lists are as follows:

List of localities of the extreme north where the decree of the Presidium of the Supreme Soviet of the USSR of 1 August 1945 "On privileges for persons working in regions of the extreme north" is valid

All islands of the Arctic Ocean and of the Bering and Okhotsk Seas adjacent to it.
Murmanskaya Oblast', except for Kandalakshskiy Rayon.
Kamchatskaya Oblast', including Koryakskiy Natsional'nyy Okrug.
Ayano-Mayskiy, Tuguro-Chimikanskiy, and Okhotskiy Rayony of Khabarovskiy Kray.
Vostochno-Sakhalinskiy and Rybnovskiy Rayony, the town of Okha with the inhabited places subject to the town soviet of Okha, Severo-Kuril'skiy, Kuril'skiy, and Yuzhno-Kuril'skiy Rayony of Sakhalinskaya Oblast'.*
Srednekanskiy, Ol'skiy, Severo-Evenskiy, Omsukchanskiy, Susumanskiy, Ten'kinskiy and Yagodinskiy Rayony, the town of Magadan, and Chukotskiy Natsional'nyy Okrug of Magadanskaya Oblast'.
Noril'sk* in Krasnoyarskiy Kray.

List of remote localities equated to regions of the extreme north, in which the decree of the Presidium of the Supreme Soviet of the USSR of 1 August 1945 "On privileges for persons working in regions of the extreme north" is valid with diminished percentage pay increments and supplementary leave periods.

Arkhangel'skaya Oblast'—Nenetskiy Natsional'nyy Okrug; Mezenskiy and Leshukonskiy Rayony.
Murmanskaya Oblast'—Kandalakshskiy Rayon.
Amurskaya Oblast'—Dzheltulakskiy, Zeyskiy, Zeysko-Uchurskiy, Nyukzhinskiy and Selemdzhinskiy Rayony.



Map of northern USSR illustrating "the extreme north" and "the soviet north".

Khabarovskiy Kray—Verkhne-Bureinskiy, Nizhne-Amurskiy, imeni Poliny Osipenko, Takhtinskiy and Ul'chskiy Rayony, the town of Sovetskaya Gavan' and the rural locality annexed to it.
Primorskiy Kray—Terneyskiy and Tetyukhinskiy* Rayony, and the regions of Bukhta Ol'ga and Bukhta Vladimir.
Yakutskaya ASSR—in its entirety.
Irkutskaya Oblast'—Katanganskiy, Bodaybinskiy, Kirenskiy, Kazachinskiy-Lenskiy, Ust'-Kutskiy, Nizhne-Ilimskiy, Bratskiy, and Mamsko-Chuyskiy Rayony.
Krasnoyarskiy Kray—Taymyrskiy Natsional'nyy Okrug, Evenkiyskiy Natsional'nyy Okrug; Severo-Yeniseyskiy, Udereyskiy, Boguchanskiy, Yeniseyskiy, Kezhemskiy, Yartsevskiy, and Turukhanskiy Rayony; the town of Igarka.
Tyumenskaya Oblast'—Khanty-Mansiyskiy Natsional'nyy Okrug, Yamalo-Nenetskiy Natsional'nyy Okrug.
Tomskaya Oblast'—Aleksandrovskiy, Bakcharskiy, Vasyuganskiy, Kargasokskiy, Krivosheinskiy, Molchanovskiy, Parabel'skiy, Pudinskiy, Chainskiy, Parbigskiy and Verkhne-Ketskiy Rayony.
Komi ASSR—Izhemskiy, Kozhvinskiy, Ust'-Usinskiy, Ust'-Tsilemskiy, Troitsko-Pechorskiy, Itinskiy,* and Ukhtinskiy* Rayony, and the town of Vorkuta.*
Chitinskaya Oblast'—Kalarskiy, Tunigiro-Olekminskiy,* Tungokochenskiy,* and Bukachachinskiy coal* Rayony.
Sakhalinskaya Oblast'*—Anivskiy, Gornozavodskiy, Kirovskiy, Korsakovskiy, Krasnogorskiy, Lesogorskiy, Makarovskiy, Nevel'skiy, Poronayskiy, Tomarinskiy, Chekhovskiy, Shirokopadskiy, and Yuzhno-Sakhalinskiy Rayony.

(* Administrative districts added by amendments to the law, 1945–56.)

N.B. Both lists are expressed in terms of administrative boundaries valid in 1956, and also include amendments made up to that date.

Another example of a recent definition of "the extreme north" for a particular administrative purpose is to be found in the building industry. This definition has not yet acquired the force of law, but will probably do so in time. It is contained in a document entitled "Projected rules and norms for planning and building inhabited places in the extreme north and north-east of the USSR".[6] The area of application is shown in the map. In this case, the extent is determined primarily on the basis of permafrost factors.

The remaining term is "the Soviet north". This has been put forward by Slavin,[3] because he denies that "the extreme north" in its various legal definitions will meet all cases. In particular, he argues, consideration of economic development and exploitation of resources demands definition by another criterion. This he finds in a factor he calls *obzhitost'* [literally "built-upness"], of which the most important component is population density, and he selects the level of less than 5 persons per sq.km. Since the process of development will change the population density, it is necessary also to attach a date; 1917 is chosen, in order to be able to measure Soviet achievement (hence the term "Soviet north"). The southern boundary of Slavin's "Soviet north" is also shown on the map, the information being taken from the maps in his paper. The biggest difference between it and the boundary of "the extreme north" is in European Russia, it being here that post-revolutionary development is most marked.

In conclusion, it is apparent that there is not yet any agreed solution to the problem of defining the north of the USSR for economic and administrative purposes. The greatest precision is to be found in the legal definitions of "the extreme north", but these have the disadvantage of always having been designed for particular purposes and being subject to amendment.

Acknowledgement

The author wishes to thank Academician I. P. Gerasimov for his help.

References

[1] S. V. Slavin. Razmeshcheniye proizvoditel'nykh sil na severe vo vtorom pyatiletii [Distribution of productive forces in the north in the second five year period]. *Sbornik "Problemy severa"* ["*Problems of the north*" *handbook*]. Moscow, 1933.

[2] M. A. Sergeyev. K voprosu o primenenii termina "Krayniy sever" [On using the term "the extreme north"]. *Letopis' Severa* [*Chronicle of the North*], No. 1, 1949, p. 189–208.

[3] S. V. Slavin. O ponyatii "Sovetskiy sever" [On the concept "the Soviet north"]. *Problemy Severa* [*Problems of the North*], Vypusk 2, 1958, p. 253–65.

[4] *Narodnoye zhozyaystvo RSFSR. Statisticheskiy sbornik* [*Economy of the R.S.F.S.R. Statistical handbook*]. Moscow, 1957, 317 p.

[5] *Sbornik vazhneyshikh zakonov i postanovleniy o trude* [*Collection of the most important laws and decrees on labour*]. Moscow, 1958, p. 114–27. [The laws are here reprinted, with notes on subsequent amendments and changes in administrative districts.]

[6] A. N. Popov, ed. *Razvitiye prozvoditel'nykh sil vostochnoy Sibiri. Stroitel'naya industriya i promyshlennost' stroitel'nykh materialov* [*Development of productive forces of eastern Siberia. Building industry and building materials industry*]. Moscow, 1960, p. 87–88. [The information is quoted in a paper by B. V. Murav'yev.]

FIELD WORK

ARCTIC UNIT OF FISHERIES RESEARCH BOARD OF CANADA: FIELD ACTIVITIES IN 1959

[Summarized from *Fisheries Research Board of Canada Annual Report 1959–60*, Ottawa, 1960, p. 123–28. A summary of activities during 1958, wrongly titled 1959, appeared in the *Polar Record*, Vol. 10, No. 66, 1960, p. 276–77.]

Fisheries investigations

The Arctic Unit is undertaking field work to assess fish stocks in Yukon, Mackenzie, Keewatin and Franklin territories, and to provide a biological basis for management of subsistence, commercial, and sporting fisheries.

Kasegalik Lake and River and tributaries, the principal freshwater system of the Belcher Islands in south-eastern Hudson Bay, were surveyed during 1959. Arctic char (*Salvelinus alpinus*) proved to be the dominant species of economic value. Near the river mouth these fed mainly on fish rather than amphipods. Populations of both sea-run and freshwater char occur in the lakes in summer; there is evidence that the former do not go to sea every year after maturing, and growth reduction during summers spent in a lake may cause their considerable size variation. Growth is slow, the average large-sized fish being 16 years old.

A survey was also made of twenty lakes lying in the hitherto little-known barren grounds between the west coast of Hudson Bay and the line from LaMartre to Dismal Lakes. Four parties, of two or three men, each studied five lakes for periods of about a fortnight, being transported between sites by Otter aircraft. Whitefish (*Coregonus* sp.) and lake trout (*Salvelinus namaycush*) were dominant everywhere, followed in abundance by round whitefish (*Prosopium cylindraceum*), pike (*Esox lucius*), cisco (*Leucicthys* sp.), grayling (*Thymallus signifer*) and burbot (*Lota lota*). Arctic char were frequent only in waters draining directly into the sea. Growth rates and productivity varied considerably from lake to lake. Clinton Colden, Whitefish, and Wholdaia Lakes, in the southern sector of the region studied, had the lowest potential annual yield of fish per unit of lake area, while the zone between Great Bear and Great Slave Lakes appeared the most productive. The northern sector seems to be intermediate.

Both freshwater and sea-run char populations occur in Hazen Lake, Ellesmere Island, and growth here is about 30 per cent slower than in the Sylvia Grinnell River system at Frobisher Bay, Baffin Island, and at Prince of Wales Island.

The commercial fishery for Arctic char at the mouth of the Sylvia Grinnell River operated for a second consecutive year and accounted for 22,000 lb. out of a total of 47,500 lb. removed by all kinds of fisheries. This total is higher than is desirable. Experimental fishing at the mouth of the Jordan River nearby yielded inadequate returns for commercial development.

Marine mammal investigations

Walrus (*Odobaenus rosmarus*). The walrus populations at the hauling-out sites at Coats and Bencas Islands in northern Hudson Bay were counted from the air. The total slightly exceeded that given by seaborne surveys in 1955 and 1956, and indicates that the species is maintaining itself. Age analysis of samples from Grise Fiord, Ellesmere Island, and Igloolik, in northern Foxe Basin, suggests that the

stock is not being heavily utilized there either. The total annual kill in the eastern Arctic, including Greenland, is about 1400.

Harbour Seal (*Phoca vitulina*). Age analysis of the 1959 catch shows the Harbour Seal population in the Maritime Provinces to be heavily exploited, mature seals are scarce and the total population has probably been halved since 1950 when the bounty was increased from $5 to $10. Off Labrador and Newfoundland, where the bounty was only increased five years ago, no such population decline has occurred.

Grey Seal (*Halichoerus grypus*). An analysis has been made of growth rates and ages of Grey Seals in Miramichi Bay, New Brunswick.

Pilot Whale (*Globicephala melaena*). Pilot Whales off Newfoundland feed predominantly on squid, total daily consumption averaging 60–90 lb. per animal. The stomach of an average-sized whale (13 ft. long) holds 20 to 30 lb., and digestion takes about 8 hours. If the mean daily intake per whale is set at 60 lb., the total annual food consumption totals 21,900 lb. of squid and fish, probably mostly squid.

Biological oceanography

Studies have been concentrated in eastern Hudson Bay and James Bay, where economic development may be undertaken in the near future. In this region, the MV *Calanus* made detailed physical, chemical and biological observations at seventy-two stations. Chlorophyll, light- and dark-bottle oxygen, and ^{14}C techniques were used to estimate primary production at two stations near the Belcher Islands. A carbon production rate of 0·3 to 1·0 mg./m.^{2}/day at 50 m. depth is indicated for late July and August; maximum production probably occurs in mid June to early July. Phytoplankton studies revealed a succession of spring diatoms associated with ice (Pennatae) and summer diatoms (Centriceae) similar to that found in Foxe Basin; such successions are thought typical of the Arctic and sub-Arctic. The more favourable conditions in Hudson Bay are reflected in the occurrence there of flagellated groups rare further north. Species typical of Atlantic and Pacific waters were recorded, and the number of athecate dinoflagellates seen was almost as high as that reported for the Pacific Ocean.

The standing crop of zooplankton in Hudson Bay averages 8·45 g./m.^{2}, the highest values of 32·05 g./m.^{2}, occurring north of the Belcher Islands and the lowest, 2·48 g./m.^{2}, among the islands and between them and Quebec. The standing crop in James Bay is much lower (average 3·20 g./m.^{2}) than in Hudson Bay. Carnivorous forms are most numerous in the deeper, colder water while the herbivores, which make up the greater of the biomass, are more numerous in the upper layers. In Foxe Basin the average standing zooplankton crop is estimated at 2·58 g./m.^{2}.

A well-defined bottom ridge was found between the north-east of Belcher islands and Quebec, separating the intermediate water into two distinct basins each with different characteristics.

The 38 ft. shallow-draught experimental fishing vessel MV *Salvelinus* was completed in Vancouver in 1959, and will be used for exploratory fishing in the western Arctic.

CANADIAN OPERATION "BACK RIVER", 1960

[Summarized from a note by W. W. Heywood, Geological Survey of Canada.]

Reconnaissance mapping of about 55,000 square miles in the north of the District of Keewatin was completed during the summer of 1960, using two Bell 47-G helicopters and supported by a Norseman and a Cessna 180 aircraft. The bedrock geology was mapped by W. W. Heywood, J. D. Aitken, W. L. Davison, and M. Tremblay; B. G. Craig was responsible for the surficial geology; and J. L. Blanchard acted as

radio operator and technician. Summer student assistants were A. L. Fournier, L. Murray, and D. Sawa.

The area is bounded as follows: the 102nd meridian south from the Arctic coast to lat. 67° W., thence east to the 100th meridian, thence south to the 66th parallel thence east to the 90th meridian, thence north to the Arctic coast at Pelly Bay, thence northerly and westerly along the Arctic coast and the District of Franklin boundary to the coast at the 102nd meridian.

Camp supplies were flown from Churchill to Baker Lake, the main supply base, earlier in the season and three caches of aircraft fuel were sent out from Baker Lake by DC-3.

During the operation the helicopters flew 475 hours, the Norseman 340 hours, and the Cessna 140 hours.

The first camp was established by Norseman on 4 June at an unnamed lake about 10 miles west of Franklin Lake. The main party arrived on 7 June by DC-3 from Churchill, and the helicopters arrived the same day. The first geological flights were made two days later. Five main and two subsidiary camps were occupied. From these a series of parallel east–west flight lines were made at 6-mile intervals. Boothia and Adelaide Peninsulas were flown in a radial pattern. The last geological traverse was flown on 21 August.

Flying conditions in the field area were excellent from 9 June to 31 July, and only 8 days were lost due to weather during this period; of the 81 days spent in the field area, 61 were suitable for geological traversing by helicopter. The ski-wheel Norseman left the field camp, located on a lake in the Hayes River, on 14 June. The Cessna returned on floats on 3 July and the Norseman on 8 July

The oldest rocks recognized are schists and gneisses derived from sedimentary and volcanic rocks. They occupy a belt, up to about 40 miles wide, that extends south-westerly from the east boundary of the mapped area in lat 67° 10′ N., almost to the south boundary in long. 93° 30′ W. They are intruded by numerous sills, dykes, plugs and irregular bodies of peridotite and altered peridotite up to about $2\frac{1}{2}$ miles in maximum dimension; gossans are numerous. Much of the remainder of the mapped area is underlain by granitic, gneissic, and highly schistose rocks. A belt of mainly crystalline limestone, dolomite, and quartzite, 4 to 6 miles wide, extends about 120 miles north-easterly from lat. 67° 10′ N., long. 95° 50′ W. This belt appears to be younger than the widespread granitic, gneissic, and highly schistose rocks, but is cut by granitic and pegmatitic dykes and sills.

Nearly horizontal Ordovician and Silurian limestone, dolomite, and sandstone underlie Adelaide Peninsula, and the western coastal plain of Boothia Peninsula between Cape Selkirk and Spence Bay.

Ice flow features in the area indicate that, early in the period of retreat, movement was north-easterly towards the Gulf of Boothia and north-westerly towards Victoria Strait and Queen Maud Gulf. Later, all ice movement was north-westerly as the ice margin retreated toward the Keewatin Ice Divide.

SOVIET DRIFTING STATIONS IN THE ARCTIC OCEAN, 1960–61

[From *Vodnyy Transport*, 4 August 1960, 16 March, 4 April, 18 April 1961; *Izvestiya*, 2 May 1961; and Moscow Radio, 29 July and 27 August 1960.]

Two stations were functioning in the spring of 1960: SP-8, already manned for a year, was in about lat. 79° N., long. 180° when the new party under N. I. Blinov took over; SP-9 was a new station, set up in April 1960 in lat. 77° 23′ N., long. 163° E. under V. A. Shamont'yev.

During the year, SP-8 drifted in general in a north-easterly direction, and gave

the appearance of continuing in a rough circle. If it does this, it will be following the same course as SP-2 in 1950–54, and will provide further information on the closed circulation in the "Beaufort depression" (the basin on the American side of the Mendeleyev ridge). It was relieved in mid-April 1961 by a party of seventeen under Yu. Konstantinov. Its position on 15 March was lat. 83° 51° N., long. 151° 44′ W.

SP-9 drifted at first slowly north-north-westwards, then gathered speed and moved northwards and north-eastwards. The new leader, I. Romanov, and his group were ready to take over in late March, the position of the station on 15 March having been lat. 86° 28′ N., long. 179° 12′ E. The station had latterly been following a course roughly parallel to that of SP-8 and about 300 km. away. But very severe fracturing of the station site and surrounding floes made evacuation difficult, and continued occupation impossible. The last men were finally evacuated on 16 May, and the relief party were not put into the field.

The scientific programme at both stations remained much the same, with most emphasis on oceanography and meteorology. Each station had to make local moves during the year owing to ice fracture, but programmes were continued.

Air support was provided at intervals during the year, as usual. SP-8 had a light AN-2 aircraft based at the station during the spring and summer which was used for ice reconnaissance, scientific work, and for ferrying stores from the main landing strip on the ice to the camp.

The spring relief expedition in 1961, known as "Sever-13", was led by P. A. Gordiyenko, with P. P. Moskalenko as chief pilot. The remote positions of the two drifting stations necessitated the establishment of an intermediate station on the ice north of the Laptev Sea. In addition to relieving the drifting stations, "Sever-13" set up twenty-four automatic weather stations (DARMS) on the ice of the Kara, Laptev, East Siberian and Chukchi Seas.

UNITED STATES ARCTIC RESEARCH LABORATORY ICE STATION NO. 1: "ARLIS-1"

[Summarized from *Naval Research Reviews*, December 1960.]

During September 1960, a scientific research station was set up by the United States Arctic Research Laboratory, Point Barrow, Alaska, on an ice floe in about lat. 75° N., long. 136° W. in the Beaufort Sea. The floe was then about 420 miles north-east of Point Barrow, and measured 2·3 by 3·5 miles, with an average thickness of 8 ft.

The station was established from USS *Burton Island*, and consisted of ten pre-fabricated buildings weighing, with supplies and equipment, a total of 65 tons. The research programme includes physical oceanography, micrometeorology, sea ice physics, marine biology, marine geology and geophysics.

The first party of scientists were: K. Bennington, leader and ice physicist; C. Knight, ice physicist; G. E. Brayton, oceanographer; A. M. Hanson, micro-meteorologist and radio officer; and J. Tibbs, marine biologist.

Positions of the station during the first two months were as follows: 1 October, in lat. 75° N., long. 140° 35′ W.; 31 October in lat. 74° 37′ N., long. 148° 53′ W.; 27 November, in lat. 74° 18′ N., long. 153° 6′ W.

In establishing the station in lat. 75° N., USS *Burton Island* set up a new high latitude record for a ship under her own power.

STATIONS AND REFUGE HUTS IN THE FALKLAND ISLANDS DEPENDENCIES (EXCLUDING SOUTH GEORGIA)

[The following list has been compiled by Brian Roberts and Ena Thomas, May 1961. Stations have been continuously occupied since establishment unless otherwise indicated. Numbers of occupants are given only for the years in which these are known. For map see p. 627. Previous lists for 1953 and 1955 were published in the *Polar Record*, Vol. 7, No. 48, 1954, p. 227–30, and Vol. 8, No. 52, 1956, p. 57–62.]

1. *UNITED KINGDOM*

Locality of station	*Date established*	*Notes*
Goudier Island, Port Lockroy, Wiencke Island, Palmer Archipelago (Base A) (64° 49′ S., 63° 30′ W.)	11 February 1944	9 men wintered in 1944; reduced to 4 men in February 1945; evacuated 8 April 1947; re-occupied by 2 men on 23 January 1948; increased to 4 men in winter 1948; evacuated in mid-February 1949; re-occupied by 4 men on 24 January 1950; evacuated 13 February 1951; re-occupied by 5 men on 15 December 1951; reduced to 4 men in winter 1955; increased to 5 men in winter 1956; increased to 6 men in winter 1957; reduced to 5 men in winter 1958; number maintained up to present time
Whalers Bay, Deception Island, South Shetland Islands (Base B) (62° 59′ S., 60° 34′ W.)	6 February 1944	4 men wintered in 1944; buildings destroyed by fire in September 1946; personnel lived in nearby whaling factory; station rebuilt in 1946–47; 5 men wintered in 1947; reduced to 4 men in winters of 1948–51; increased to 6 men early in 1952; reduced to 5 men in winters of 1953 and 1954; increased to 6 men in winters of 1955–57 increased to 7 men in winter 1958; reduced to 6 men in winter 1959; increased to 11 men in winter 1960 (6 of these had been destined for Stonington Island but had failed to get there); number maintained up to present time
Cape Geddes, Laurie Island, South Orkney Islands (Base C) (60° 42′ S., 44° 34′ W.)	22 January 1946	4 men wintered in 1946; evacuated 17 March 1947
Hope Bay, Trinity Peninsula (Base D) (63° 24′ S., 56° 59′ W.)	12 February 1945	13 men wintered in 1945; reduced to 8 men in January 1946; increased to 9 men in April 1947; reduced to 7 men in winter 1948; hut destroyed by fire 8 November 1948; evacuated 4 February 1949; station re-established by 11 men on 4 February 1952; reduced to 10 men in winter 1953; increased to 12 men in winters of 1954–57; increased to 14 men in winter 1958; increased to 19 men in winter 1959; reduced to 17 men in winter 1960; reduced to 14 men in winter 1961

Locality of station	*Date established*	*Notes*
Stonington Island, Marguerite Bay, Fallières Coast, west Graham Land (Base E) (68° 11′ S., 67° 00′ W.)	24 February 1946	10 men wintered in 1946; increased to 11 men in April 1947; evacuated 12 February 1950; re-occupied by 6 men on 10 March 1958; evacuated 7 March 1959; re-occupied by 2 men from Horseshoe Island on 14 August 1960; increased to 4 men on 21 August 1960; increased to 11 men in winter 1961
Fossil Bluff, Alexander Island (71° 20′ S., 68° 17′ W.)	February 1961	Established by air from Stonington Island; 3 men wintering in 1961
Marina Point, Galindez Island, Argentine Islands, off Graham Coast, west Graham Land (Base F) (65° 15′ S., 64° 15′ W.)	14 February 1935	Hut built on Winter Island by British Graham Land Expedition and occupied until 17 February 1936; hut destroyed in winter 1946; site re-occupied by 4 men of FIDS on 9 January 1947; increased to 5 men in winter 1951; reduced to 4 men in winter 1952; increased to 5 men in winter 1953. New hut built on Galindez Island by FIDS in 1953–54 and occupied by 10 men in winter 1954; reduced to 9 men in winters of 1955 and 1956; increased to 11 men in winters of 1957–59; increased to 20 men in winter 1960 (6 of these had been destined for Adelaide Island but failed to get there); 13 men wintering in 1961
Admiralty Bay, King George Island, South Shetland Islands (Base G) (62° 05′ S., 58° 25′ W.)	25 January 1947	Temporarily occupied by 2 men; evacuated 23 March 1947; re-occupied by 5 men on 18 January 1948; increased to 6 men in winter 1949; reduced to 4 men in winter 1950; increased to 5 men in winters of 1951–55; increased to 6 men in winter 1956; increased to 8 men in winter 1957; reduced to 7 men in winter 1958; increased to 9 men in winter 1959; reduced to 8 men in winter 1960; evacuated 19 January 1961
Signy Island, South Orkney Islands (Base H) (60° 43′ S., 45° 36′ W.)	14 March 1947	4 men wintered in 1947; reduced to 3 men in winter 1948; increased to 4 men in winter 1949; increased to 5 men in winters of 1950–54; increased to 7 men in winter 1955; increased to 8 men in winters of 1956 and 1957; reduced to 6 men in winter 1958; increased to 9 men in winter 1959; reduced to 6 men in winter 1960; reduced to 5 men in winter 1961
Prospect Point, Graham Coast, west Graham Land (Base J) (66° 00′ S., 65° 20′ W.)	2 February 1957	6 men wintered in 1957; reduced to 5 men in winter 1958; evacuated 23 February 1959
Arthur Harbour, Anvers Island, Palmer Archipelago (Base N) (64° 46′ S., 64° 05′ W.)	28 February 1955	6 men wintered in 1955 and 1956; reduced to 5 men in winter 1957; evacuated 10 January 1958

Locality of station	*Date established*	*Notes*
Danco Island, off Danco Coast, west Graham Land (Base O) (64° 43′ S., 62° 35′ W.)	2 March 1956	6 men wintered in 1956 and 1957; reduced to 5 men in winter 1958; evacuated 22 February 1959
Southern Adelaide Island (Base T) (67° 46′ S., 68° 54′ W.)	2 February 1961	6 men wintering in 1961
View Point, Duse Bay, Trinity Peninsula (Base V) (63° 32′ S., 57° 23′ W.)	11 May 1953	Hut occupied intermittently by Hope Bay personnel for meteorological work, sealing and survey, until 1 October 1953; occupied semi-permanently in March–November 1954, and January–November 1955; new hut erected in March–April 1956 and occupied continuously from 1 March 1956 to present time
Detaille Island, Lallemand Fjord, off Loubet Coast, west Graham Land (Base W) (66° 52′ S., 66° 48′ W.)	24 February 1956	8 men wintered in 1956; increased to 10 men in winters of 1957 and 1958; evacuated 1 April 1959
Horseshoe Island, Marguerite Bay, Fallières Coast, west Graham Land (Base Y) (67° 48′ S., 67° 18′ W.)	11 March 1955	8 men wintered in 1955; increased to 10 men in winter 1956; reduced to 9 men in winter 1957; reduced to 6 men in winters of 1958 and 1959; reduced to 4 men in winter 1960; evacuated 21 August 1960
Halley Bay, Caird Coast, Coats Land (Base Z) (75° 31′ S., 26° 38′ W.)	16 January 1956	Established as Royal Society's International Geophysical Year station; 10 men wintered in 1956; 21 men in 1957; 20 men in 1958. Transferred to FIDS administration, 14 February 1959; 12 men wintered in 1959; increased to 16 men in winter 1960; increased to 25 men in winter 1961
"Shackleton", Filchner Ice Shelf (77° 59′ S., 37° 09′ W.)	30 January 1956	Commonwealth Trans-Antarctic Expedition base; 8 men wintered in 1956; 16 men wintered in 1957; evacuated 27 December 1957
"South Ice", Coats Land (81° 57′ S., 28° 52′ W.)	4 February 1957	Commonwealth Trans-Antarctic Expedition advance base; 3 men wintered in 1957; evacuated 6 January 1958
Barry Island, Debenham Islands, Marguerite Bay, Fallières Coast, west Graham Land (68° 08′ S., 67° 07′ W.)	29 February 1936	Hut built by British Graham Land Expedition and occupied until 12 March 1937; repaired by FIDS in 1946, but not re-occupied; probably destroyed by Argentines in about March 1951
Sandefjord Bay, Coronation Island, South Orkney Islands (60° 37′ S., 46° 02′ W.)	12 February 1945	Hut erected, but not occupied. Dismantled in 1956
Portal Point, Reclus Peninsula, Danco Coast, west Graham Land (64° 30′ S., 61° 46′ W.)	7 December 1956	Hut occupied semi-permanently for survey work in 1957 and 1958
Close west of Orford Cliff, Cliff, Loubet Coast, west Graham Land (66° 54′ S., 66° 30′ W.)	Mid-February 1957	Hut occupied intermittently for geological and survey work in 1957 and 1958
North-west Blaiklock Island, off Loubet Coast, west Graham Land (67° 32′ S., 67° 13′ W.)	March 1957	Hut occupied intermittently for survey work

2. *ARGENTINA*

Locality of station	*Date established*	*Notes*
"Orcadas", Scotia Bay, Laurie Island, South Orkney Islands (60° 45′ S., 44° 43′ W.)	1904	This meteorological station has been continuously maintained since Dr Bruce, of Scottish National Antarctic Expedition, invited 4 Argentines to operate it, starting 22 February 1904; 7 men wintered in 1948; 11 men in 1950 and 1953; probably 9 men in 1955; 10 men in 1957; and 11 men in 1959. Manned since 1951 by naval personnel
"General San Martín", Barry Island, Debenham Islands, Marguerite Bay, Fallières Coast, west Graham Land (68° 08′ S., 67° 08′ W.)	29 March 1936	Site of 1936–37 British Graham Land Expedition base. The Argentine station "General San Martín" was established there on 8 March 1951; 6 men wintered in 1951; 20 men in 1952 and 1953; 4 men in 1954; 10 men in 1955; 11 men in 1959. Manned by army personnel. Additional hut and other installations built in February 1956. Station destroyed by fire, 19 March 1958, but not evacuated. In operation during summer season only since 1959–60
"Melchior", Gamma Island, Melchior Islands, Palmer Archipelago (64° 20′ S., 62° 59′ W.)	31 January 1947	9 men wintered in 1947; probably 8 men in 1948; 10 men in 1951; 11 men in 1953; probably 10 men in 1955 and 1957; 9 men in 1959. Manned by naval personnel
"Primero de Mayo", Fumarole Bay, Deception Island, South Shetland Islands (62° 59′ S., 60° 43′ W.)	20 November 1947	10 men wintered in 1948, 1949 and 1950; increased to 11 men in 1951–54; probably reduced to 10 men in 1955; probably increased to 12 men in 1957; increased to 20 men in 1959; reduced to 14 men in 1960. Manned by naval personnel
"Almirante Brown", Coughtrey Peninsula, Danco Coast, west Graham Land (64° 53′ S., 62° 53′ W.)	1949–50 season	Unoccupied in 1950; 4 men wintered in 1951; station partially destroyed by fire during the year; rebuilt January 1952; 5 men wintered in 1952 and 1953; probably 7 men in 1955; 7 men in 1956; probably 9 men in 1957; 8 men in 1958; 7 men in 1959. In operation during summer season only since 1959–60. Manned by naval personnel
"Esperanza", Hope Bay, Trinity Peninsula (63° 24′ S., 56° 59′ W.)	14 January 1952	5 naval men wintered in 1952; 15 naval and army men wintered in 1953. Station extended in 1953–54 to accommodate separate naval and army detachments; about 12 naval and 15 army men wintered in 1954; probably 9 naval and 15 army, air force and civilian men in 1955. Naval detachment withdrawn in December 1956. 23 men (18 service and 5 civilian) wintered in 1958, civilians using naval huts. Naval huts completely destroyed by fire, 16 October 1958. 15 men wintered in 1959; 14 men in 1960

Locality of station	*Date established*	*Notes*
"Teniente Cámara", Half Moon Island, Moon Bay, Livingston Island, South Shetland Islands (62° 36′ S., 59° 54′ W.)	March 1952	Unoccupied in 1952; occupied by wintering party (probably 6 men) in March 1953; probably 8 men wintered in 1955 and 1956; 9 men in 1957 and 1958; 7 men in 1959. Manned by naval personnel and, during IGY, by civilian scientists. In operation during summer season only since 1959–60
"General Belgrano", Filchner Ice Shelf (77° 58′ S., 38° 48′ W.)	4 January 1955	14 men wintered in 1955; 18 men in 1957; 17 men in 1959
"Teniente Matienzo", Larsen Nunatak, Seal Nunataks, off east Graham Land (64° 58′ S., 60° 03′ W.)	15 March 1961	Established jointly by army and air force personnel. Occupied by wintering party in 1961. This permanent station has replaced the refuge "San Antonio" (q.v.), established in 1959
Admiralty Bay, King George Island, South Shetland Islands (62° 05′ S., 58° 25′ W.)	January 1948	Small hut erected; occupied temporarily by 2 men, for one month only, in 1948; since demolished
"Jubany", Potter Cove, King George Island, South Shetland Islands (62° 14′ S., 58° 38′ W.)	27 January 1948	Small refuge hut found, unoccupied, by FIDS party in August 1949; possibly rebuilt in 1951–52; extended in 1953–54 and again in 1954–55, and occupied by naval personnel during both summer seasons. In December 1954–January 1955, an air unit with flying boats was temporarily based there. Again occupied by naval personnel in summers of 1955–56, 1956–57, 1957–58, 1959–60 and 1960–61
"Capitán Fliess", Neko Harbour, Andvord Bay, Danco Coast, west Graham Land (64° 51′ S., 62° 33′ W.)	9 March 1949	Refuge hut and meteorological observatory; possibly occupied temporarily in summer 1949–50; destroyed in 1951; rebuilt early in 1952; again occupied temporarily by naval personnel in summers of 1953–54 and 1954–55.
"Thorne", Telefon Bay, Deception Island, South Shetland Islands (62° 55′ S., 60° 42′ W.)	23 March 1949	Refuge hut; destroyed in 1951; rebuilt early in 1952; occupied temporarily by naval personnel in summers of 1952–53, 1953–54 and 1954–55; destroyed by a gale in winter 1955; rebuilt and occupied temporarily by one naval officer and two ratings in summer 1955–56
"Teniente Lasala", Pendulum Cove, Deception Island, South Shetland Islands (62° 58′ S., 60° 36′ W.)	4 April 1959	Refuge hut; destroyed November 1950; rebuilt early in 1952; occupied temporarily by naval personnel (3 men) in January 1953, and again in summers of 1954–55 and 1955–56
"Petrel", Welchness, Dundee Island, off Trinity Peninsula (63° 28′ S., 56° 17′ W.)	1951–52 season	Refuge hut; occupied temporarily by naval personnel each summer between 1952–53 and 1959–60
"Martín Güemes", Duse Bay, Tabarin Peninsula (63° 30′ S., 57° 10′ W.)	23 October 1953	Hut occupied intermittently by army personnel from Hope Bay in 1954 and 1955; abandoned and unusable since 1957; destroyed by ice in 1960 [name apparently transferred to new hut on Fivemile Rock]

Locality of station	*Date established*	*Notes*
"Teniente Cándido de la Sala", Whalers Bay, Deception Island, South Shetland Islands (62° 56′ S., 60° 36′ W.)	14 January 1953	Hut occupied temporarily by 4 naval men; removed by British on 15 February 1953
"Bahía Dorian", Dorian Bay, Wiencke Island, Palmer Archipelago (64° 49′ S., 63° 30′ W.)	23 February 1953	Refuge hut; occupied temporarily by naval personnel in summer of 1953–54
"Plumerillo", Refuge Islands, Rymill Bay, west Graham Land (68° 20′ S., 57° 02′ W.)	28 April 1953	Refuge hut established by army personnel for use of field parties travelling southwards from "General San Martín"
"Bryde, Islote Ricardo", off east coast of Bryde Island, Paradise Harbour, Danco Coast, west Graham Land (64° 53′ S., 62° 56′ W.)	12 November 1953	Refuge hut; occupied temporarily by naval personnel in summer of 1953–54; in disrepair, November 1958
"Ballvé", Ardley Island, off south-western King George Island, South Shetland Islands (62° 12′ S., 58° 54′ W.)	6 December 1953	Refuge hut; occupied temporarily by naval personnel each summer between 1953–54 and 1958–59
"Gurruchaga", Harmony Cove, Nelson Island, South Shetland Islands (62° 18′ S., 59° 10′ W.)	15 December 1953	Refuge hut; occupied temporarily by naval personnel in summers of 1953–54, 1954–55 and 1957–58
"Rada Lote", Selvick Cove, Danco Coast, west Graham Land (64° 39′ S., 62° 34′ W.)	23 December 1953	Refuge hut established by naval personnel; destroyed, possibly by a gale, on 25 December 1953
"Betbeder", north-eastern tip of Snow Hill Island, James Ross Island group, off Trinity Peninsula (64° 20′ S., 56° 56′ W.)	1 January 1954	Refuge hut; occupied temporarily by naval personnel in summer of 1954–55
"Capitán Cobbett" (ex-"Primavera"), southern entrance point of Cierva Cove, Hughes Bay, Danco Coast, west Graham Land (64° 10′ S., 60° 57′ W.)	23 January 1954	Refuge hut; occupied temporarily by naval personnel in summers of 1954–55, 1955–56, 1956–57 and 1957–58
"Capitán Caillet Bois", Mikkelsen Harbour, Trinity Island, off Palmer Coast, north-west Graham Land (63° 54′ S., 60° 47′ W.)	10 December 1954	Refuge hut; occupied temporarily by naval personnel in summers of 1954–55, 1956–57 and 1958–59
"Groussac", Port Circumcision, Petermann Island, off Graham Coast, west Graham Land (65° 11′ S., 64° 10′ W.)	8 February 1955	Refuge hut; occupied temporarily by naval personnel in summers of 1954–55, 1956–57 and 1957–58
"Cristo Redentor", View Point, Duse Bay, Trinity Peninsula (63° 32′ S., 57° 24′ W.)	25 May 1955	Refuge hut; enlarged and occupied intermittently by army personnel during 1956
"Antonio Moro", Summit Ridge, Tabarin Peninsula (63° 27′ S., 57° 02′ W.)	20 June 1955	Refuge hut established by army personnel on Summit Pass; destroyed by gale during 1957; rebuilt on Summit Ridge in October 1958 for use of Hope Bay survey parties working on Tabarin Peninsula; again destroyed by gale in about March 1959

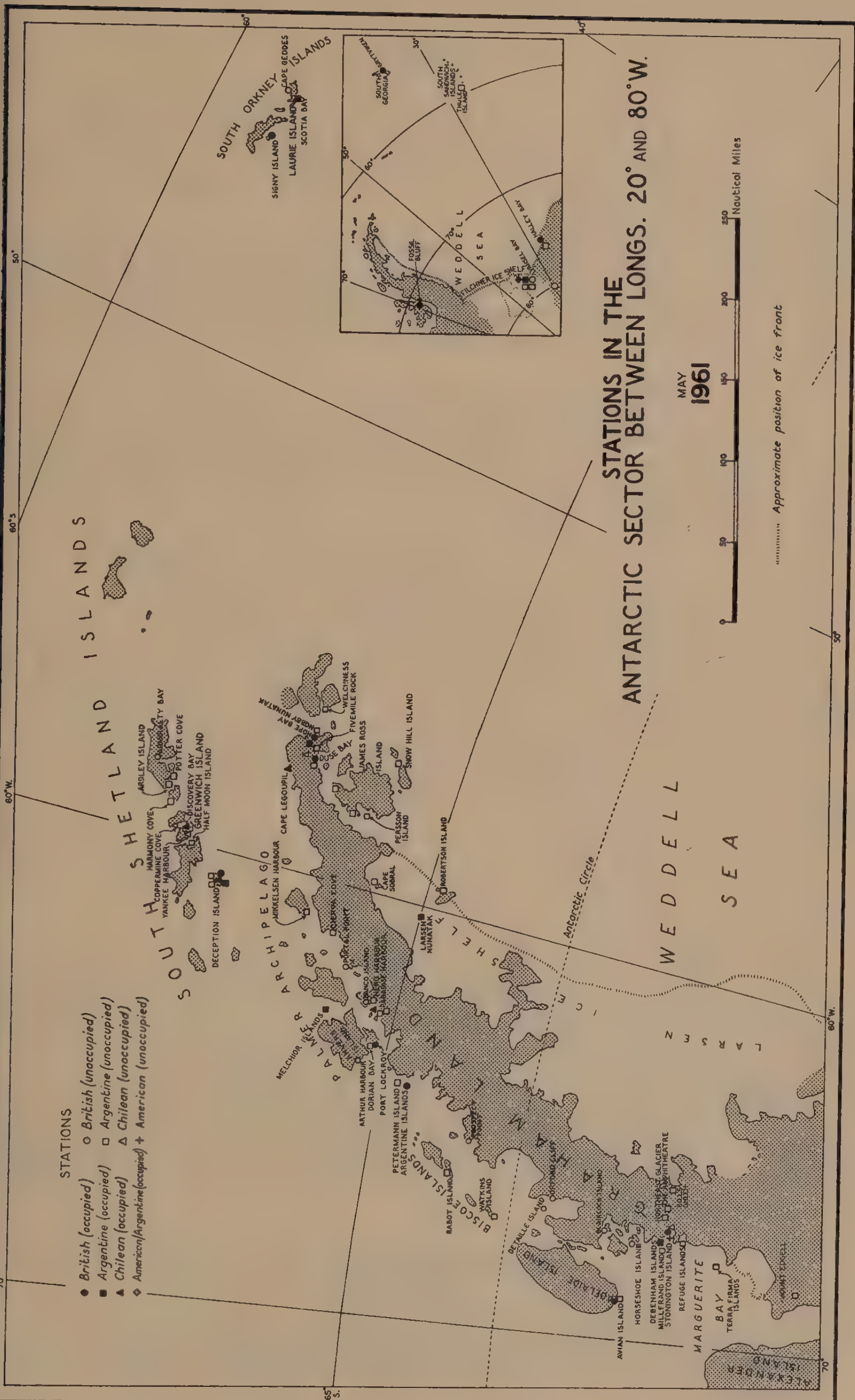
Locality of station	*Date established*	*Notes*
"Teniente Esquivel" (ex-"Thule"), Ferguson Bay, Thule Island, South Sandwich Islands (59° 27′ S., 27° 16′ W.)	25 January 1955	Refuge hut; occupied temporarily by naval personnel in summers of 1954–55 and 1955–56; evacuated 14 January 1956
"Libertador General San Martín", Persson Island in Röhss Bay, James Ross Island, off Trinity Peninsula (64° 11′ S., 58° 21′ W.)	17 August 1955	Refuge hut established by army personnel for use of Hope Bay parties working on James Ross Island
"Yapeyú", Northeast Glacier, Fallières Coast, west Graham Land (68° 05′ S., 66° 41′ W.)	4 November 1955	Refuge hut established by army personnel for use of field parties travelling from "General San Martín" to Trail Inlet; occupied temporarily in summer of 1955–56
"Capitán Estivariz", island close west of Watkins Island, Biscoe Islands, off west Graham Land (66° 26′ S., 67° 12′ W.)	29 February 1956	Refuge hut; occupied temporarily by naval personnel in summers of 1955–56 and 1956–57
"San Roque", Robertson Island, off east Graham Land (65° 17′ S., 59° 18′ W.)	25 January 1956	Refuge hut established by army personnel for use of parties travelling southwards from Hope Bay
"Chacabuco", in vicinity of The Amphitheatre, central Graham Land (68° 06′ S., 67° 10′ W.)	21 November 1956	Refuge hut established by army personnel for use of field parties travelling from "General San Martín" to Trail Inlet
"Maipú", Bills Gulch area, Bowman Coast, east Graham Land (68° 06′ S., 65° 58′ W.)	14 December 1956	Refuge hut established by army personnel for use of field parties travelling from "General San Martín" to Trail Inlet and as a base for work along the east coast of Graham Land
"Cadete Guillochón", western Rabot Island, Biscoe Islands, off west Graham Land (65° 59′ S., 65° 58′ W.)	24 February 1957	Refuge hut; occupied temporarily by naval personnel in summer of 1956–57
"Granaderos", Hayrick Island, Terra Firma Islands, Marguerite Bay, west Graham Land (68° 42′ S., 67° 42′ W.)	17 October 1957	Refuge hut established by army personnel for use of field parties travelling southwards from "General San Martín"
"17 de Agosto", Millerand Island, Marguerite Bay, west Graham Land (68° 09′ S., 67° 09′ W.)	17 August 1957	Refuge hut established by army personnel for use of survey and glaciological field parties working from "General San Martín"
"Paso de los Andes", Avian Island, Henkes Islands, off southern Adelaide Island (67° 49′ S., 68° 40′ W.)	26 October 1957	Refuge hut established by army personnel for use of ships' personnel unloading stores for "General San Martín" when ice conditions prevent direct access to the station; occupied by 2 men in summer of 1957–58
"Salta", near junction of Filchner Ice Front with Coats Land (78° 01′ S., 35° 48′ W.)	12 November 1957	Refuge hut established by army personnel; reported to be used during IGY for observation of ice movement

Locality of station	*Date established*	*Notes*
"Conscripto Ortíz", east of Sturm Cove, Danco Coast, west Graham Land (64° 54′ S., 62° 57′ W.)	? 1957	Unoccupied refuge hut established by naval personnel; since demolished
"Islas Malvinas", Nobby Nunatak, Tabarin Peninsula (63° 25′ S., 56° 59′ W.)	? early 1958	Refuge hut established by army personnel and occupied intermittently during 1958; the roof was blown off late in 1958; still derelict early in 1960
"Nogal de Saldán", about 10 miles south of Mount Edgell, east side of George VI Sound (69° 35′ S., 68° 13′ W.)	16 September 1958	Refuge hut established by army personnel for use of field parties working southwards from "General San Martín"
"Virgen de las Nieves", Filchner Ice Shelf (79° 10′ S., 38° 53′ W.)	2 December 1958	Refuge hut established by army personnel for use of parties travelling southwards from "General Belgrano"
"San Antonio", Larsen Nunatak, Seal Nunataks, off east Graham Land (64° 58′ S., 60° 02′ W.)	20 March 1959	Refuge hut established by army personnel for use of field parties travelling southwards from Hope Bay. Replaced by wintering station "Teniente Matienzo" (q.v.), established in 1961
"Guarani", near Cape Sobral, Nordenskjöld Coast (64° 30′ S., 59° 40′ W.)	23 June 1959	Refuge hut established by army personnel for use of field parties travelling southwards from Hope Bay
"San Carlos", Brandy Bay, James Ross Island, off Trinity Peninsula (63° 49′ S., 57° 59′ W.)	4 October 1959	Refuge hut established by army personnel for use of Hope Bay field parties working on James Ross Island
"San Juan", south-west of Hidden Lake, James Ross Island, off Trinity Peninsula (64° 04′ S., 58° 21′ W.)	9 October 1959	Refuge hut established by army personnel for use of Hope Bay field parties working on James Ross Island
"Güemes", Fivemile Rock, Tabarin Peninsula (63° 30′ S., 57° 10′ W.)	1959–60 season	Refuge hut established by army personnel [name of "Güemes" apparently transferred from old hut, now destroyed, in Duse Bay]
"Corrientes", close south of Halley Bay, Coats Land (75° 34′ S., 26° 36′ W.)	10 January 1961	Unoccupied refuge hut established by army personnel with a view to future installations in this locality on a larger scale

3. *CHILE*

"Arturo Prat", Discovery Bay, Greenwich Island, South Shetland Islands (62° 29′ S., 59° 39′ W.)	6 February 1947	6 men wintered in 1947; 9 men in 1948; 8 men in 1949 and 1950; 7 men in 1951; 8 men in 1952; 6 men in 1953; 8 men in 1954–56; 9 men in 1957; 8 men in 1958; 9 men in 1959. Manned by naval personnel
"General Bernardo O'Higgins", Cape Legoupil, Trinity Peninsula (63° 19′ S., 57° 55′ W.)	18 February 1948	"General Bernardo O'Higgins" station established in February 1948; 6 men wintered in 1948–51; 7 men in 1952 and 1953; 8 men in 1954–56. Station extended by addition of "Luis Risopatron" scientific huts in February 1957 to accommodate IGY personnel. 27 men (16 service and 11 civilian)

Locality of station	*Date established*	*Notes*
"General Bernardo O'Higgins" (*cont.*)		wintered in 1957. "General Bernardo O'Higgins" station partially destroyed by fire on 27 November 1957, and personnel transferred to "Luis Risopatron" huts. 27 men (16 service and 11 civilian) wintered in 1958. Manned by army personnel and, during IGY, by civilian scientists. "Luis Risopatron" huts reported destroyed by fire in March 1958
"Presidente Gonzalez Videla", Waterboat Point, Danco Coast, west Graham Land (64° 49′ S., 62° 52′ W.)	January 1951	This site was occupied by T. W. Bagshawe and M. C. Lester, January 1921–January 1922. The Chilean station was established there in January 1951; 6 men wintered in 1951; 8 men in 1952–56; 12 men (8 service and 4 civilian) in 1957 and 1958. Manned by air force personnel (and during IGY by civilian scientists) until February 1961, when it was transferred to University of Chile; 9 men wintering in 1961
"President Aguirre Cerda", Pendulum Cove, Deception Island, South Shetland Islands (62° 56′ S., 60° 36′ W.)	January 1955	6 men wintered in 1955. Additional hut built during summer 1955–56. 6 men wintered in 1956; 8 men in 1957–59. Manned mainly by air force personnel
Coppermine Cove, Robert Island, South Shetland Islands (62° 23′ S., 59° 41′ W.)	1949–50 season	Unoccupied refuge hut
Yankee Harbour, Greenwich Island, South Shetland Islands (62° 32′ S., 59° 46′ W.)	January 1953	Unoccupied refuge hut
Whalers Bay, Deception Island, South Shetland Islands (62° 59′ S., 60° 35′ W.)	January 1953	Hut temporarily occupied when Chilean ships visiting; removed by British on 15 February 1953
Stonington Island, Marguerite Bay, Fallières Coast, west Graham Land (68° 11′ S., 67° 00′ W.)	1955–56 season	Unoccupied refuge hut
Nearly 6 miles north-east of Theodolite Hill, Trinity Peninsula (63° 25′ S., 57° 26′ W.)	? 1957	Small refuge hut found, unoccupied, by FIDS party in 1957
4. *UNITED STATES*		
Stonington Island, Marguerite Bay, Fallières Coast, west Graham Land (68° 11′ S., 67° 00′ W.)	11 March 1940	Hut built by U.S. Antarctic Service Expedition and occupied until 22 March 1941; re-occupied by Ronne Antarctic Research Expedition on 12 March 1947; evacuated 20 February 1948
5. *ARGENTINA/UNITED STATES*		
"Ellsworth", Filchner Ice Shelf (77° 43′ S., 41° 07′ W.)	January 1957	Established as American IGY station. Operated jointly with Argentina since January 1959. 29 men wintered in 1959; 27 men in 1960; 28 men in 196



STATIONS IN THE ANTARCTIC SECTOR BETWEEN LONGS. 20° AND 80° W.
MAY 1961
STATIONS
● British (occupied)
○ British (unoccupied)
■ Argentine (occupied)
□ Argentine (unoccupied)
▲ Chilean (occupied)
△ Chilean (unoccupied)
◆ American/Argentine (occupied)
+ American (unoccupied)
Nautical Miles
0 50 100 150 200 250
Approximate position of ice front
SOUTH ORKNEY ISLANDS
SIGNY ISLAND
LAURIE ISLAND
CAPE GEDDES
SCOTIA BAY
SOUTH SHETLAND ISLANDS
ARDLEY ISLAND
POTTER COVE
DISCOVERY BAY
GREENWICH ISLAND
HALF MOON ISLAND
HARMONY COVE
COPPERMINE COVE
YANKEE HARBOUR
DECEPTION ISLAND
PALMER ARCHIPELAGO
MIKKELSEN HARBOUR
CAPE LEGOUPIL
HOPE BAY
DUSE BAY
JAMES ROSS ISLAND
SNOW HILL ISLAND
WELCHNESS
FIVEMILE ROCK
PERSSON ISLAND
CAPE SOBRAL
ROBERTSON ISLAND
LARSEN NUNATAK
MELCHIOR ISLANDS
ARTHUR HARBOUR
DORIAN BAY
PORT LOCKROY
PETERMANN ISLAND
ARGENTINE ISLANDS
BISCOE ISLANDS
WATKINS ISLAND
RABOT ISLAND
DETAILLE ISLAND
ADELAIDE ISLAND
AVIAN ISLAND
HORSESHOE ISLAND
DEBENHAM ISLANDS
MILLERAND ISLAND
STONINGTON ISLAND
REFUGE ISLANDS
MARGUERITE BAY
TERRA FIRMA ISLANDS
ALEXANDER ISLAND
GRAHAM LAND
LARSEN ICE SHELF
WEDDELL SEA
Antarctic Circle
SOUTH GEORGIA
SOUTH SANDWICH ISLANDS
THULE ISLAND
FOSSIL BLUFF
FILCHNER ICE SHELF
HALLEY BAY
60° S.
65° S.
70°
60° W.
50°
40°
30°

NOTES

UNITED STATES ARMY COLD REGIONS RESEARCH AND ENGINEERING LABORATORY (CRREL)

[Summarized from information supplied by the Technical Liaison Branch, United States Army Engineer District, Chicago]

With effect from 1 February 1961 the Snow, Ice and Permafrost Establishment of the United States Army (SIPRE) has been re-named Cold Regions Research and Engineering Laboratory (CRREL). The Arctic Construction and Frost Effects Laboratory (ACFEL) at Waltham, Mass., was placed under the same direction.

Facilities for the new organization are being built at Hanover, New Hampshire, and are to include twenty-two cold rooms, in which temperatures from −50° C. (−58° F.) can be regulated and maintained within close limits, and laboratories for soil investigations, physics, chemistry, electronics, air photography and environmental research.

CANADIAN GOVERNMENT ICEBREAKERS

[From information supplied by the Department of Transport, Canada.]

A new Diesel electric, triple-screw icebreaker, *John A. Macdonald*, has been built for the Department of Transport of the Canadian Government by Davie Shipbuilding Limited, Quebec, and was commissioned on 7 September 1960. She becomes Canada's largest and most powerful icebreaker, and will be used to supply outposts in Arctic Canada in the summer and to assist St Lawrence River navigation in winter.

The principal dimensions are: length overall, 315 ft.; moulded breadth, 70 ft.; loaded draught, 28 ft.; and gross tonnage, 6,186 tons. Her total shaft horse power is 15,000, giving a maximum speed of 16 knots with a radius of action of 20,000 miles at a cruising speed of 10 knots.

Canada's fleet of polar ships in November 1960 comprised the following icebreakers and ice-strengthened ships: large icebreakers, *John A. Macdonald*, *D'Iberville*, *Labrador*; medium-sized icebreakers, *Camsell*, *Sir Humphrey Gilbert*, *N. B. Maclean*, *Sir William Alexander*, *Wolfe*, *Montcalm*, *Saurel*, *Ernest Lapointe*, *Alexander Henry*; ice-strengthened ships, *Baffin* (survey ship), *C. D. Howe*, *Tupper*, *Simon Fraser*, *Edward Cornwallis*, *Walter E. Foster*, *Sir James Douglas*, *Montmorency*; ice-strengthened ferries, *William Carson* and *Abegweit*. One new ice-strengthened ship, to be called *Hudson*, is at present under construction.

WILDLIFE SANCTUARIES IN ALASKA

[Summarized from information supplied by U.S. Department of the Interior.]

Two new wildlife sanctuaries were established in Alaska during 1960.

Izembek National Wildlife Range comprises about 649 sq.miles on the north

side of Alaska Peninsula, near the western end. It includes rangeland, tideland and tundra, and supports great numbers of waterfowl, particularly Brant Geese (*Branta bernicla*), Emperor Geese (*Philacte canagica*) and Canada Geese (*Branta canadensis*).

Kuskokwim National Wildlife Range, later named *Clarence Rhode National Wildlife Range*, is situated in the Yukon–Kuskokwim River delta in western Alaska, and consists of about 2,924 sq.miles of marshland and tundra extending from the mouth of the Kinak River north to Hooper Bay and east to Dall Lake and the head of Baird Inlet. It is one of the largest wildfowl breeding grounds in North America, and also supports a population of red and white foxes, mink, otters and musk rats.

"MAN LIVING IN THE ARCTIC" CONFERENCE, MASSACHUSETTS, 1960

[Summarized from information supplied by the Quartermaster Research and Engineering Command, United States Army.]

A conference, sponsored by the National Academy of Science–National Research Council Advisory Board on Quartermaster Research and Development, the Arctic Institute of North America, and the United States Army Quartermaster Corps, was held at Natik, Massachusetts, on 1 and 2 December 1960. The object of the conference was to review the contributions made by the Quartermaster Corps to man's ability to live in the Arctic, and to forecast future requirements in the light of developments taking place in Arctic regions.

There were four sessions: the Arctic, chairman Dr Paul A. Stiple; Quartermaster Corps contributions to man living in the Arctic, chairman Dr John C. Reed; scientific approaches to solving the problems of man living in the Arctic, chairman Dr Carl R. Eklund, and the expanding utilization of the Arctic, chairman Dr Walter Wood.

THE COLDEST PLACES ON EARTH

[Summarized from a note by D. J. George in *Weather*, Vol. 16, No. 3, 1961, p. 144–50.]

In Asia, the coldest place appears to be Verkhoyansk, in north-east Siberia, (lat. 67° 33′ N., long. 133° 23′ E., altitude 122 m. (400 ft.)) with a temperature of −90° F. (−68° C.) measured on 5 and 7 February 1892. Another place, Oymekon, (lat. 63° 16′ N., long. 143° 15′ E., altitude 800 m. (2,624 ft.)) recorded the same temperature on 6 February 1933. During the years 1931 to 1935 Oymekon had a mean monthly temperature a few degrees colder than Verkhoyansk.

In Greenland, a temperature of −84·6° F. (−64·8° C.) was measured at the "Eismitte" station (lat. 71° 12′ N., long. 39° 54′ W., altitude 2,993 m. (9,819 ft.)) by A. Wegener's expedition on 20 March 1931, and also at the central station of Expéditions Polaires Français (lat. 70° 55′ N., long. 40° 38′ W., altitude 2,993 m. (9,819 ft.)) on 21 February 1950. A temperature of −86·8° F. (−66° C.) was measured on 9 January 1954 at the "Northice"

station of the British North Greenland Expedition (lat. 78° 04′ N., long. 38° 29′ W., altitude 2,345 m. (7,692 ft.)).

In Canada, the lowest temperature on record is −81° F. (−62·8° C.) measured at Snag, Yukon Territory (lat. 62° 23′ N., long. 140° 23′ W., altitude 646 m. (2,119 ft.)) on 3 February 1947.

In Antarctica, the lowest temperature on record is −126·9° F. (−88·3° C.) which was recorded at "Vostok" (lat. 78° 27′ S., long. 106° 52′ E.) on 24 August 1960.

The coldest upper air temperatures so far recorded were also found over Antarctica. A temperature of −132·2° F. (−91·2° C.) was measured at a height of 155 mb. (approx. 13,400 m. or 43,950 ft.) above "Maudheim" (lat. 71° 03′ S., long. 10° 56′ W., altitude 37·5 m. (123 ft.)) on 11 August 1950, and a temperature of −135·4° F. (−93° C.) at 21,000 m. (68,880 ft.) over the South Pole on 17 July 1958. A temperature of −143° F. (−97° C.) was measured at a height of 20 mb. (approx. 23,000 m. or 75,450 ft.) above Halley Bay (lat. 75° 31′ S., long. 26° 36′ W., altitude 30 m. (100 ft.)) on 9 August 1959. The previous record low upper air temperature was −133·4° F. (−91·9° C.) measured at a height of 17,330 m. (56,850 ft.) over Batavia, Java, on 5 November 1913.

SUPPLIES ORGANIZATION OF THE INSTITUTO ANTÁRTICO ARGENTINO

[Summarized from C. A. Perticarari, Supervision del planeo logistico de las campanas del Instituto Antártico Argentino. *Contribucion del Instituto Antárctico Argentino*, No. 21, 1959.]

The planning, ordering and packing of supplies and equipment for Argentine parties working in the Antarctic is carried out by the technical and purchasing departments of the Instituto Antártico Argentino. These summer parties, usually consisting of three to six men self-sufficient in stores and equipment, are known as Campaña Antártica de Verano del Instituto Antártico Argentino (CAVIAA), a name which, however, also covers the naval stations of "Esperanzo", "General San Martin" and "General Belgrano", and the scientific station "Ellsworth".

Catalogue of supplies

Requirements are divided into four groups: (1) Food; (2) Clothing and equipment; (3) Field supplies; (4) Camp supplies. These are subdivided, and given code references for cataloguing purposes as follows:

(1) Food (*víveres*): Dry food, i.e. flour, biscuits, sugar, requiring no special packing, VS (*víveres secos*).

Packed food, i.e. preserves, liquids, requiring special containers, VE (*víveres envasados*).

Fresh foods, vegetables, meat, kept in refrigeration, VF (*víveres frescos*).

Patrol rations, VP (*víveres de patrulla*).

(2) Clothing and equipment (*vestuario y equipo*):

Summer clothing, VV (*vestuario de verano*).

Winter clothing, VI (*vestuario de invierno*).

Equipment, EQ (*equipo*).

(3) Field supplies (*material de campaña*):
Instruments, IN (*instrumental*).
Land transport, TT (*transporte terrestre*).
Sea transport, TM (*transporte marítimo*).
Air transport, TA (*transporte aéreo*).

(4) Camping supplies (*campamento*):
Tents and accessories, CA (*carpas y accesorios*).
Crockery and cutlery, VJ (*vajilla*).
Kitchen utensils, BA (*batería de cocina*).
Tools, HE (*herramientas*).
Containers, EN (*envases*).
Fuels, CO (*combustibiles*).
Hardware, FE (*material de ferretería*).
Household goods, LI (*material de limpieza*).
Drugs, BF (*botiquín y farmacia*).
Stationery, LB (*librería*).
Miscellaneous, VA (*varios*).

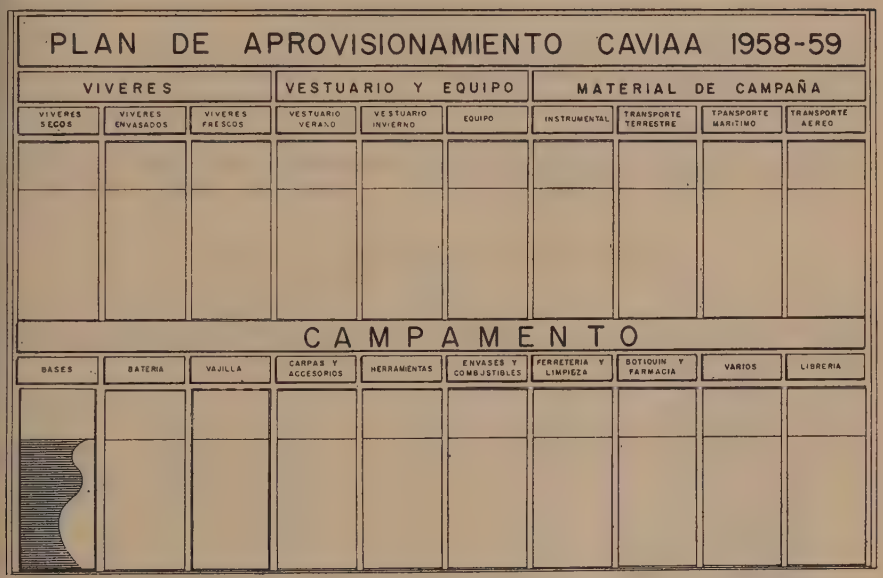


Fig. 1. Supply-plan board for Antarctic Summer Campaign of CAVIAA, 1958–59.

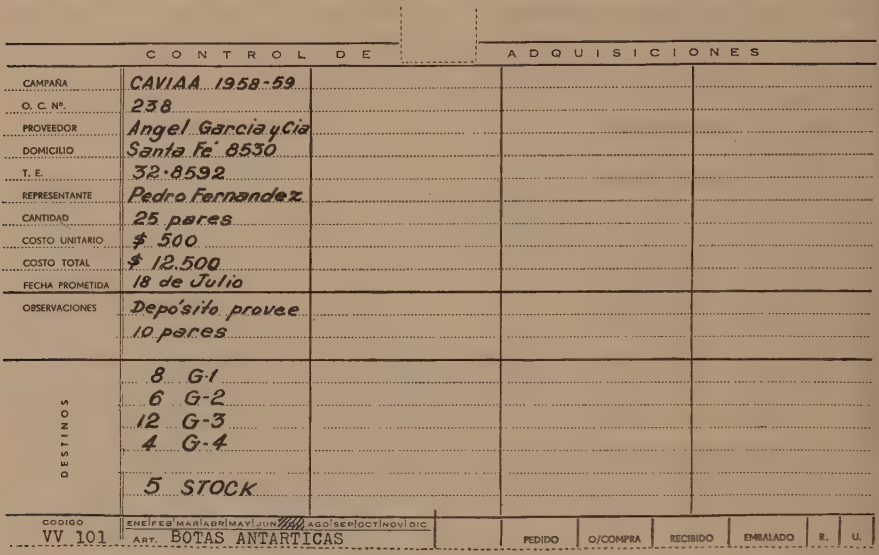
Planning and purchasing

As soon as an operation has been planned, usually in April for the following Antarctic summer, the technical and purchasing departments prepare the purchase, packing and shipment of supplies, and an ingenious system has been devised to eliminate errors and omissions.

Fig. 1 shows schematically the supply-plan board for the Antarctic summer campaign of CAVIAA, 1958–59.

Fig. 2 illustrates the control card for each item purchased. It is inserted

under the relevant heading in the supply-plan board. In this case the order is for Antarctic boots; Code No. VV 101; order No. 238; manufacturer, Angel Garcia y Cia; address, Santa Fé 8530; telephone No. 32-8592; sales representative Pedro Fernandez; quantity, 25 pairs; cost per pair $500; total cost $12,500; date of delivery, 18 July; Note, 10 pairs from depot stock;



CONTROL DE ADQUISICIONES

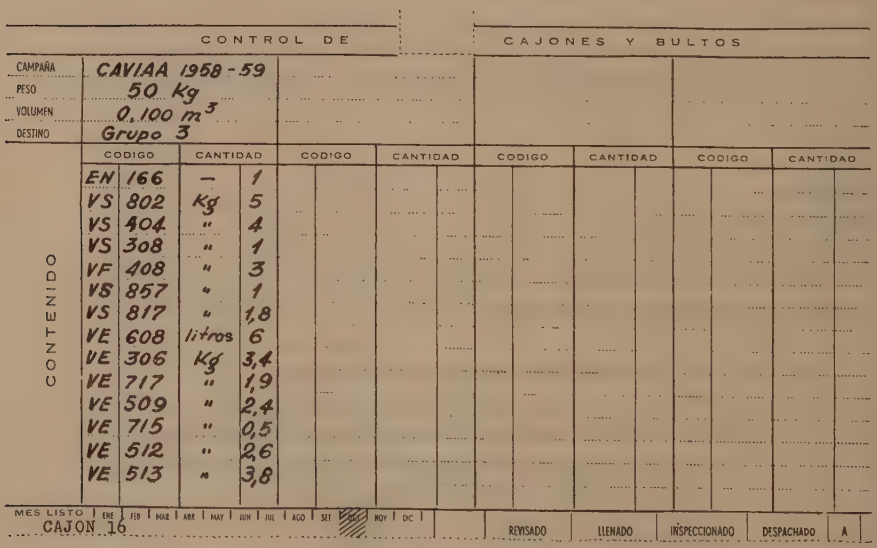
CAMPAÑA	CAVIAA 1958-59
O. C. Nº.	238
PROVEEDOR	Angel Garcia y Cia
DOMICILIO	Santa Fé 8530
T. E.	32-8592
REPRESENTANTE	Pedro Fernandez
CANTIDAD	25 pares
COSTO UNITARIO	$ 500
COSTO TOTAL	$ 12.500
FECHA PROMETIDA	18 de Julio
OBSERVACIONES	Depósito provee 10 pares
DESTINOS	8 G-1 6 G-2 12 G-3 4 G-4 5 STOCK

CODIGO VV 101 — ART. BOTAS ANTARTICAS

ENE | FEB | MAR | ABR | MAY | JUN | AGO | SEP | OCT | NOV | DIC

PEDIDO | O/COMPRA | RECIBIDO | EMBALADO | R. | U.

Fig. 2. Stock card used in purchase of supplies.



CONTROL DE CAJONES Y BULTOS

CAMPAÑA	CAVIAA 1958-59
PESO	50 Kg
VOLUMEN	0,100 m^3
DESTINO	Grupo 3

CONTENIDO

CODIGO	CANTIDAD		CODIGO	CANTIDAD	CODIGO	CANTIDAD	CODIGO	CANTIDAD
EN 166	—	1						
VS 802	Kg	5						
VS 404	"	4						
VS 308	"	1						
VF 408	"	3						
VS 857	"	1						
VS 817	"	1,8						
VE 608	litros	6						
VE 306	Kg	3,4						
VE 717	"	1,9						
VE 509	"	2,4						
VE 715	"	0,5						
VE 512	"	2,6						
VE 513	"	3,8						

MES LISTO: CAJON 16 — ENE | FEB | MAR | ABR | MAY | JUN | JUL | AGO | SET | OCT | NOV | DIC

REVISADO | LLENADO | INSPECCIONADO | DESPACHADO | A

Fig. 3. Contents card for each box packed for despatch.

destination, 8 pairs to group 1, 6 to group 2, 12 to group 3, 4 to group 4, 5 to depot stock. As each operation is completed the relevant heading on the card is covered with a sliding plastic indicator of different colour for each group of supplies, i.e. month in which goods are promised (in Fig. 2 this is July), order placed (*pedido*), order paid for (*o/compra*), goods received (*recibido*), goods packed (*embalado*). The final two sections "R" and "U", indicate a reminder to the manufacturer if the goods are behind time, and urgent. The purchase cards have four vertical columns on each side so may be used for eight years.

Packing

All supplies are packed in special rope-handled boxes designed to meet various requirements, but weighing not more than 50 kg. A special despatch board is used to check consignments to each centre or group, and a card (Fig. 3) is kept for each box, and filed on the despatch board. The card records the expedition concerned, the weight and cubic volume of the box, and its destination. Then follows a list of the contents with individual weights; then the month on which it is to be despatched; the fact that it has been issued for use (*revisado*), that it has been packed (*llenado*); that it has been inspected (*inspeccionado*) and finally that it has been despatched (*despachado*). As each operation is completed the relevant section is covered by a coloured marker. An "A" indicates that some special action must be taken in connexion with packing. A card with full details of the contents of each box is supplied to the Group Leader.

UNITED STATES GOVERNMENT DEPARTMENTS AND AGENCIES INTERESTED IN THE ANTARCTIC

[Reprinted from *Congressional Record*, Sub-committee No. 3 of the Committee of Armed Services. Consideration of H.R. 3923 and H.R. 6269. [No. 33], 23 July 1959, p. 2524–27.]

A. *List*

1. Department of Defence: Joint Chiefs of Staff, Office of Special Operations:

(*a*) Department of the Navy:
   1. Task Force 43.
   2. Office of Naval Research.
   3. Hydrographic Office.
   4. Bureau of Medicine and Surgery.
   5. Bureau of Aeronautics.
   6. Bureau of Yards and Docks.
   7. Bureau of Supplies and Accounts.

(*b*) Department of the Army:
   1. Office of the Chief of Staff for Research and Development.
   2. Corps of Engineers (SIPRE).*
   3. Signal Corps.

* Since 1 February 1961, part of United States Army Cold Regions Research and Engineering Laboratory.—*Ed.*

4. Quartermaster Corps.
5. Transportation Corps.

(*c*) Department of the Air Force:
1. Director of Research and Development.
2. Air Force Cambridge Research Center.
3. Arctic, Desert, Tropic Information Center.

2. Department of State.

3. Department of the Interior:
(*a*) United States Geological Survey.
(*b*) United States Fish and Wildlife Service.

4. Department of Commerce:
(*a*) National Bureau of Standards.
(*b*) United States Coast and Geodetic Survey.
(*c*) United States Weather Bureau.

5. National Science Foundation: Office for International Geophysical Yea

6. United States National Academy of Science.

7. Central Intelligence Agency.

8. Atomic Energy Commission.

9. Office of Defense Mobilization.

10. Department of Health, Education and Welfare:
(*a*) Food and Drug Administration.
(*b*) National Institutes of Health.

11. National Archives.

12. Library of Congress.

13. Smithsonian Institution:
(*a*) United States National Museum.
(*b*) National Zoological Park.

14. United States Board on Geographic Names.

B. *Breakdown*

1. Department of Defence:

(*a*) Both the Joint Chiefs of Staff and the Office of Special Operations a concerned with strategic aspects of the Antarctic. They also c ordinate military and naval participation in Antarctic operation particularly in the field of logistics, including sea, air and lan transport.

(*b*) Department of the Navy: the Navy has long been the leading govern mental department in Antarctic exploration. Ever since the exped tion of Lt. Charles Wilkes, utilizing the ships *Vincennes*, *Peacoc Porpoise*, *Sea Gull*, *Flying Fish* and *Relief* (1838–42), the Navy ha maintained an interest in the Antarctic. From this rich tradition ha

developed the current assignment of the Department of the Navy as executive agent for the Department of Defense in Antarctic operations.

(1) Operations:

(*a*) Chief of Naval Operations—provides co-ordination for all Navy operations in Antarctica.

(*b*) U.S. Atlantic Fleet—assigns ships, aircraft, equipment, and personnel to the U.S. Naval Support Force, Antarctica (Task Force 43).

(*c*) U.S. Naval Support Force, Antarctica (Task Force 43)—since 1955 has had the mission of carrying out the logistical support for U.S. operations in Antarctica.

(2) Science:

(*a*) Office of Naval Research—provides extensive co-operation with IGY program; assists Task Force 43 with matters pertaining to Antarctic basic programs; sponsors meteorological research, with the co-operation of Navy aerologists to acquire upper air data through use of specially equipped meteorological balloons; and supports research to study and record body heat conservation by means of respiratory heat exchanges.

(*b*) Hydrographic Office—is carrying out programs incident to the surveys which will supplement IGY oceanography, gravity, magnetism, glaciology, and meteorology programs.

(*c*) Naval Observatory—is working in conjunction with ONR.

(3) Research and Development:

(*a*) Bureau of Medicine and Surgery—is carrying out research in the field of cold weather medicine.

(*b*) Bureau of Aeronautics—is carrying on experimentation in aircraft operation in the area.

(*c*) Bureau of Yards and Docks—is interested in the effect of cold-weather operations on equipment and buildings.

(*d*) Bureau of Supplies and Accounts—is continually developing and modifying cold-weather clothing for polar operations.

(*e*) Bureau of Ships—is interested in the problems of ship operations under polar conditions.

(*c*) Department of the Army:

(1) Office of Chief of Staff for Research and Development—is furnishing personnel for scientific projects to Navy Task Force 43.

(2) Corps of Engineers—has fundamental interest in IGY glaciology program. SIPRE (Snow, Ice and Permafrost Research Establishment) is participating actively in this program.*

(3) Signal Corps—is interested in field experimentation with propagation of radio waves through deep snow.

* See footnote to p. 633.

(*d*) Department of the Air Force:

(1) Operations:

(*a*) Tactical Air Command—is the parent organization for the 18th Air Force.

(*b*) 18th Air Force—is supplying air support units for operation "Deep Freeze".

(2) Science and research and development:

(*a*) Director of Research and Development—provides personnel for research co-ordination.

(*b*) Air Force Cambridge Research Center—actively participating in the IGY aurora and airglow program. Dr Albert Crary from AFCRC is chief scientist for glaciology during the IGY.

(*c*) Research Studies Institute, Air University (formerly Arctic, Desert Tropic Information Center)—is with the Smithsonian Institution and the U.S. Fish and Wildlife Service, carrying out a subsidiary program for the banding of Antarctic birds.

2. Department of State—has long been interested in Antarctica because of the political ramifications. Recently, an Antarctic desk has been established in the Department of State to handle all political problems involving this area.

3. Department of the Interior—has been interested in Antarctic expeditions ever since the U.S. Antarctic Service Expedition of 1939–41.

(*a*) Geological Survey—is actively engaged in drafting and printing of accurate maps of the Antarctic.

(*b*) Fish and Wildlife Service—is carrying out a program of banding Antarctic birds for migration, habits and other tests.

4. Department of Commerce:

(*a*) National Bureau of Standards—is concerned with carrying out the ionospheric physics program of IGY in Antarctica.

(*b*) Coast and Geodetic Survey—is interested both in mapping programs in the field and the geomagnetism program of the IGY.

(*c*) Weather Bureau—has a major interest in the IGY meteorology program.

5. National Science Foundation—assumes responsibility for requesting funds from Congress to sponsor the USNC–IGY scientific program, including the portion required for Antarctic research; and considers grants-in-aid for research in all fields of science pertaining to the Antarctic, including those falling outside the current IGY program.

6. National Academy of Sciences:

(*a*) U.S. National Committee for the International Geophysical Year (USNC–IGY)—represents U.S. scientists internationally concerning IGY programs. Through its technical panels, develops scientific content of programs and nominates scientists to carry them out.

(*b*) Antarctic Committee for IGY—co-ordinates U.S. Antarctic IGY activities. Establishes logistic requirements, and Personnel Selection Board approves scientific personnel for IGY Antarctic bases. In addition to approximately eight personnel associated with the above committees, six representatives employed by IGY funds accompanied Deep Freeze I, two of whom wintered over.

7. Central Intelligence Agency—is interested in the Antarctic for the purpose of co-ordinating the intelligence activities of the several Government departments and agencies in the interest of national security under the direction of the National Security Council.

8. Atomic Energy Commission—is interested in the Antarctic both as a possible source of radioactive material and as a test area involving the effect of radiation on foods.

9. Office of Defence Mobilization—is interested in the natural resources potential which the Antarctic may possess.

10. Department of Health, Education, and Welfare:

(*a*) Food and Drug Administration—is interested in cached foodstuffs left in Antarctica before the 1945 atom bomb explosions as a comparison of the effects of radiation on food.

(*b*) National Institutes of Health—the Institute of Infectious Diseases is interested in lung fungus diseases of penguins removed from their natural habitat.

11. National Archives—being the national depository for all permanent Government records, has a passive interest in U.S. Antarctic exploration.

12. Library of Congress—is interested in obtaining all available literature on Antarctica to supplement its collection. On Antarctic matters the demand by Government agencies and individual researchers exceeds the supply.

13. Smithsonian Institution:

(*a*) National Museum.

(*b*) National Zoological Park.

Both are interested in all specimens obtained from Antarctic regions.

14. U.S. Board on Geographic Names—is concerned with the naming of physiographic features in Antarctica.

"PETER" SNOW-MILLING MACHINES

[Summarized from information supplied by Expéditions Polaires Françaises and Robert Aebi, Zurich.]

"Peter" snow-milling machines, manufactured by Robert Aebi of Zurich, have been used for several seasons, and with success, both in the Arctic and Antarctic regions. They are designed to remove snow by layers from the

surface downwards and their original purpose was the clearance of snow-blocked roads. Special uses have been made of them in Greenland and Antarctica, notably in excavating cavities in which buildings are erected and long passages which, roofed over, are used as covered ways or as storage units.

The machines operate by means of cutter-scoops mounted on double revolving drums which cut away the snow in their path as they move forward. Centrifugal force, and the oblique arrangement of the scoops, ensures that the loosened snow is shifted towards the two drum centres from which it is led into ejector chimneys and thrown clear. They operate on either wheels or tracks.

*Peter DHR*2. These full-sized models have been used by the United States Army in Greenland for some years, and recently in the construction of the new "Byrd" station in Antarctica, in both places mainly for excavating passages, up to 6 m. wide and 8 m. deep, which were then roofed over and put to various uses.

Brief technical data are as follows: weight 14,000 kg.; length 6·45 m.; width 2·46 m.; track width 1·7 m.; ejection distance, up to 15 m.; minimum turning radius 3·8 m.; clearing capacity up to 7500 $m.^3$ per hr.; fuel consumption about 25 l. per hr. Power is provided by a Diesel electric engine of 250 h.p. and is transmitted to a spur-distribution gear by two-plate dry clutches and thence to the milling drums and the hydraulic drive of the tracks. There are two gears, one high for travelling (from 0 to 12 m.p.h.), and one low for clearing work (from 0 to 2 m.p.h.). The rigid frame chassis is formed from sheet steel and iron girders, and is equipped with hydraulic jacks with which to adjust the height of the machine in relation to the tracks. The ejector channels can be swivelled throughout 360°, and the snow can be ejected at angles of varying steepness.

Peter Junior machines were used by the International Glaciological Expedition (EGIG) in north Greenland during the summer of 1960. The machines were dropped by parachute at the site of the "Jarl-Joset" station and used to excavate cavities for buildings, and passages for laboratory, storage and covered ways. This smaller model weighs, with tracks, 1016 kg. and is powered by a 43 h.p. engine; the clearing width is 1·2 m. and clearance throw is some 13 m. All controls are mounted on the handles.

"NODWELL" TRACKED CARRIER VEHICLES

[Summarized from information provided by the United States Antarctic Research Program and Robin Nodwell Mfg. Ltd., Calgary.]

Two models of "Nodwell" 3-axle tracked carriers were used with success during the 1960–61 Antarctic summer at "NAF McMurdo" by the United States Antarctic Research Program. These were Models RN 21 and RN 50, both of which were equipped with "personnel carriers" and used mainly for the transport of scientists and their equipment. They are reported to have proved themselves dependable and rugged carriers and prime movers, simple to operate and maintain.

"Peter Junior" snow milling machine

Photograph by J. Masson, Expéditions Polaires Françaises

"Peter" snow milling machine starting to excavate a trench. On the right is a completed trench roofed over and ready for use

Photograph by Robert Aebi, S.A.

(*Facing p.* 638)

The Model RN 50 Nodwell Tracked Carrier of the U.S. Antarctic Research Program towing sled load of baggage down the main street, McMurdo Sound, Antarctica

Photograph by National Science Foundation

Refuelling a "rollitanker" from drums dropped from an aircraft

Photograph by A. J. Heine

Model RN 21 has a net weight of 4,840 lb. and a payload of 2,100 lb. Its length is 11 ft.; width is 6 ft. 9 in.; and height is 6 ft. 10 in.; width of tracks is 28 in.; ground clearance is 10 in.; and inside turning radius is 103 in. The engine is a 6 cylinder, 223 cu.in., Ford.

Model RN 50 is a larger vehicle weighing 7,660 lb. and having a payload of 5,000 lb. Its length is 15 ft. 6 in.; width is 8 ft. 4 in.; and height is 8 ft.; width of tracks is 32 in.; ground clearance is 14 in.; and inside turning radius is 103 in. The engine is the same as in model RN 21. The rubber-toothed drive sprocket at the rear is augmented, under conditions of extreme strain, by a centre row of steel overload teeth coming into contact with the metal track.

The United States Navy received two model RN 75 carriers at "NAF McMurdo" early in January 1961, and used them for the remainder of the season. One is a personnel carrier and the other is equipped for stretcher carrying, ready in case of emergencies. These still larger vehicles operate on 40 in., tracks and have a payload of 7,500 lb.

SURFACE TRANSPORT RE-FUELLING TECHNIQUES IN ANTARCTICA, 1959–60

[By A. J. Heine, New Zealand Geographical Survey, and member of Victoria Land Traverse, 1959–60.]

The techniques described were used during the United States Victoria Land Traverse, 1959–60, a 1,520-mile journey from "Scott Base" across the Plateau to within 175 miles of "Charcot", and then to Rennick Glacier, about 200 miles west of "Hallett" station. The fuel used by the three Sno-cats was transported in drums on articulated ski sleds, and by a rolling-wheel type liquid transporter known as a "rollitanker". This transporter consists of two, wheel-shaped fuel cells mounted on a common axle, fixed in turn to a tubular drawbar. Each fuel cell is 64 in. outside diameter, 42 in. inside diameter, and 18 in. wide, and has a capacity of 500 U.S. gallons.*

The fuel was flown to a depot at the head of Skelton Glacier by United States Navy R.4D aircraft, partly in drums and partly in an extra fuel tank mounted inside the cabin. Two fuel airdrops were then made, using Globemaster C 124 aircraft. The first drop, of 56 drums, was made in lat. 74° 34′ S., long. 144° 24′ E. and the second, of 68 drums, in lat. 71° 30′ S., long. 139° 54′ E.

The airdrops were made at predetermined locations along the proposed traverse route, and after the precise position had been determined it was radioed to the traverse party, at that time some hundreds of miles distant. The locations of the airdrops were planned so that in the event of the traverse party not locating the first airdrop, it could safely return to Skelton Glacier depot and similarly, if the second depot was not found, the party would still have sufficient fuel to travel out to the coast to "Dumont D'Urville", or to return to the first airdrop for fuel left there. In both cases, however, the

* The experience gained with this technique has since led to the development of four-wheeled "rollitankers" that have been used with great success during the 1960–61 U.S. traverses.—*Ed.*

airdrop marker flags were found across the traverse route, and the airdrops located with very little difficulty.

Fuel drums were lashed to pallets in groups of four and dropped with ribbon cargo parachutes; only one parachute failed to open with the result that the drums burst on impact. Several pallets landed upside down and a great many were driven about 3 ft. into the snow. The drums were pulled out by using a Sno-cat and a heavy wire rope around the base of the pallet.

After each airdrop had been made, the aircraft circled round and dropped weighted, flagged bamboo stakes about half a mile apart and in such a way that about ten flags were dropped on each side of the site of the airdrop. The line of flags was more or less perpendicular to the traverse route. Although the flags were numbered, it was not possible to drop them all in numerical sequence; however, the numbers as found gave some indication as to the centre of the line of flags and consequently of the site of the airdrop. In both cases the line of flags was within a mile of the airdrop; this was remarkable as, after the drop had been made, the aircraft crew were unable to distinguish the pallets on the snow surface, and had to calculate their position relative to the airdrop before dropping the line of bamboos. Several poles splintered as they hit the the fairly hard snow surface, but the majority drove in about 2 ft. The 12 in. steel point on each pole was made from heavy angle iron. A small gusset was welded into the angle, about 6 in. from one end, and the bamboo (about 2 in. in diameter) was wired into the angle iron, and butted securely against the gusset. The flags were made of "day glo" material, measuring about 8 in. by 24 in., and were distinguishable in poor lighting conditions from a distance of several miles.

SCAR BULLETIN

No. 9, *September* 1961

Antarctic Meteorology. Proceedings of the symposium held in Melbourne from 18 to 25 February 1959, arranged by the Australian Bureau of Meteorology, under the auspices of the Australian Academy of Science with the endorsement of the Special Committee for the IGY (CSAGI) and the Special Committee for Antarctic Research (SCAR). Pergamon Press, 1960, 483 pp.

REVIEWED BY J. VAN MIEGHEM

During the first two international campaigns of geophysical observations (First International Polar Year, 1882–83, and Second International Polar Year, 1932–33), special interest was shown in the study of the northern polar and subpolar zones. Since then, and particularly after the Second World War, the observing network of the middle and high latitudes of the northern hemisphere had been developed considerably. As a result, at the beginning of the International Geophysical Year (IGY), 1957–58, the geophysical phenomena of the low latitudes were much less known than those of the northern high latitudes; also the phenomena of the southern polar latitudes had not yet been explored on a synoptic scale. Unfortunately the tropical network has not been greatly enlarged for the IGY; it has not even been notably improved. However, the establishment and the running of a network in Antarctica, and in the islands of the sub-Antarctic seas, has been one of the most spectacular results of the IGY.

Meteorological phenomena are influenced by media outside the terrestrial atmosphere, as well as by the various parts of the atmosphere. The observing network established in Antarctica for the IGY has therefore a twofold importance; it has given the opportunity to gather synoptic data on phenomena never hitherto observed, and it also has contributed to a better global knowledge of the terrestrial atmosphere as a whole. For example, it has been possible to make a comparison between the meteorological phenomena of the two polar zones, and to show the existence of notable asymmetries in the circulation within these two zones. Such studies show the great interest of the Melbourne Symposium, where a tentative attempt has been made to present a first synthesis of the results obtained from the observations gathered in Antarctica during 1957 and 1958. In this connexion, we must note the active participation of several meteorologists just back from Antarctica where they had been living for more than a year; it was particularly interesting to hear their lectures based on results not yet processed for publication. Four Antarctic veterans, Sir Raymond Priestley, Professor F. Debenham, Captain J. K. Davis and Dr B. S. Stilwell were also present.

It was an honour and a privilege to me to attend this excellent and vivid symposium, that deeply impressed all the participants. I enjoy recalling

this scientific gathering and the charming attentions of my Australian colleagues.

The symposium was divided into seven sessions, each of them being devoted to a well-defined subject. The quality of the contributions presented, and the interest of the discussions, have led me to give a short résumé of the essential points dealt with.

(1) *Local effects in the Antarctic.* It was shown (P. J. R. Shaw, Y. Morita and N. Murakoshi, B. L. Dzerdzeevskii, G. M. Tauber and B. Valtat) that local conditions (topography, surface inversions) generate small-scale non-geostrophic flow patterns, with marked diurnal and annual variations. The resultant contragradient downslope airflow is not completely independent of the synoptic weather situation off the coastline of the Antarctic continent. Studies of local winds in the vicinity of observing stations are of vital importance in order to indicate how far the recorded winds are representative of air motions on the synoptic scale. The streamlines of the airflow on the ice slopes of Antarctica have been determined theoretically (F. K. Ball) in the case of pure katabatic flow (when the katabatic force, proportional to gravity and inversion strength, overcompensates greatly the pressure gradient force above the inversion).

(2) *Synoptic analysis and forecasting.* Useful synoptic experience gained at the Antarctic Weather Central, "Little America", was reported (T. J. Gray *Jnr.*) and existing models, and models used in the synoptic analysis of southern hemisphere weather, were reviewed (W. J. Gibbs). Such models are even more necessary in the southern hemisphere where the analyst and the forecaster have to face great difficulties arising from the huge gaps in the network of observing stations. Two basic models have been suggested: (*a*) a double-fronted model (of the Antarctic Weather Central meteorologists) with a middle latitude polar front between maritime polar air and maritime tropical air, and an Antarctic front of orographic origin at the limit of the sea ice, and with polar anticyclones, generated near the sea ice boundary, in between the two associated zonal belts of frontal cyclones, moving from West to East; (*b*) a model in which the middle latitude circulation is mainly zonal, westerlies prevail in the region south of 40° S., cyclones enter these westerlies from the north, develop while drifting to the south and the east, enter the sub-Antarctic pressure trough, become stationary or move over the ice cap, and finally lose their identity (W. J. Gibbs). In order to secure uniformity among analysts and to render the analysis less subjective, methods for the construction of 500 mb. contour maps over the southern seas have been proposed (J. J. Talhaard and H. van Loon). These methods are based on the relationship between the surface flow patterns and the 1000–500 mb. thicknesses at existing upper air stations. Several synoptic case studies of weather systems over Antarctica and adjacent sea areas were presented, namely *The Little America Blizzard of May* 1957 (J. A. Alvarez and B. J. Lieske), and *The Explosive Stratospheric Warming of October* 1958 *above the South Pole* (K. J. Hanson). The explosive warmings of the Antarctic stratosphere generally occur after spring equinox, between mid-October and mid-November, in contrast with the explosive

warmings of the Arctic stratosphere, occurring generally well before the return of the sun in the stratosphere. The difficulties of synoptic weather analysis in the southern hemisphere are almost insurmountable as a result of the extremely large areas without a single observing station. Therefore automatic devices (such as automatic stations and weather buoys, dropsondes, constant level balloons) have been suggested to fill in the gaps in the synoptic network. No major improvement of our knowledge of the thermal and dynamic processes in the southern atmosphere can be expected as long as these gaps are not filled. Operational meteorological problems in the Antarctic were reviewed by W. S. Lanterman.

(3) *Synoptic influences in lower latitudes.* This very important problem cannot be treated adequately in the absence of a network of synoptic stations between lats. 40° and 60° S. In order to study the interactions between the Antarctic, the middle latitudes and the tropical zone, a global knowledge of the southern hemisphere is necessary. At present such a knowledge is lacking; nevertheless, some very courageous attempts have been made. At first sight, Antarctic weather seems not to have a direct influence on Australian weather, as the cold waves reaching Australia seem to originate from latitudes lower than 60° S. (A. K. Hannay, H. M. Treloar). The relationship between Antarctic surges and variations in the middle latitude zonal circulation (F. A. Berson and U. Radok), and the long-term interaction between the atmosphere of the Antarctic and that of the temperate latitude (E. B. Kraus), have been discussed. It has, however, been pointed out that the sudden stratospheric warming over Antarctica after the spring equinox, and the simultaneous rapid change in the low latitude flow patterns are both manifestations of the seasonal adjustment in the general circulation of the southern hemisphere as a whole (E. B. Kraus).

(4) *Circulation studies.* From the seven contributions presented, six were based on synoptic experience and only one on model experiments. These experiments (performed by R. H. Clarke) demonstrated the influence of an elevated ice cap around the pole, and of differences in surface roughness on the temperature field; in the high levels a greater baroclinicity is created by the presence of an ice cap, the low-level temperature changes, however, are also affected by an equatorial shift of the polar front. The "dish-pan experiment" has been performed with and without a cold dome, and with a smooth and a rough bottom. In this connexion it is worth while to mention here that the introduction of a rough bottom affects the circulation much more than the introduction of a cold dome. The experiments suggest that the difference in temperature field of the two hemispheres could be ascribed to the difference in surface friction.

Thermal interaction between the very cold Antarctic surface air and the warmer air above the adjacent seas generates circulation over the Antarctic region (A. M. Gousev). According to N. E. Kochin's theory, cyclones off the coastline of Antarctica originate in the transition layer between these two air masses. This theory has been tested.

Air motion in Antarctica, in spite of local peculiarities, is not essentially

different from, nor independent of, the air motion at lower latitudes; warm cyclones penetrate from the north in the South Pole region during the polar winter, showing that exchange processes between high and low latitudes persist throughout all the year (P. D. Astapenko).

Major changes in some parts of the middle latitude westerlies have been noted (J. C. Langfoed), namely a reversal of zonal circulation above the southern ocean in July, along the meridian of 160° E., in connexion with the formation of a blocking high in this longitude of the temperate zone.

The cancellation of the restrictions on whaling in the south Pacific Ocean for three years, beginning with the summer 1955–56, has given the first opportunity of a synoptic surface analysis of weather conditions, during the summer season, above this hitherto practically unexplored region of the earth's surface, with a data coverage far superior to the previous ones and better than may be expected in the near future. The main synoptic features of the summer circulation above the South Pacific were described, and the first sea level mean pressure chart for the periods 26 December 1955 to 10 March 1956, and 10 December 1956 to 17 March 1957, was presented (H. van Loon).

The technique of the five-day mean sea level pressure maps has been applied (I. S. Kerr) to southern latitudes in order to try and demonstrate a possible relationship between changes in the temperate latitude large scale weather systems, and major changes in the Antarctic circulation. This experiment has yielded encouraging results so far, but further work is necessary before definite conclusions can be reached.

A tentative description of geographical and seasonal distributions of cyclonic and anticyclonic centres above the southern seas has been given (S. Karelsky), in view of the usefulness of this information for the forecaster.

(5) *Snow and ice characteristics.* It has been pointed out (K. B. Mather) that in the Mawson region a sastrugi pattern reflects the katabatic flow pattern (south-east winds on the coast-line, south-west winds inland above the Lambert depressions). Sastrugi must be used with some care, however, as a measure of katabatic wind direction.

Puddles are formed in the interior of a snow layer when the heat gained in deeper layers by absorption of solar radiation is not compensated by the long wave nocturnal surface emission ("hot house" phenomena in snow layers (Y. Takahashi)).

A rocket-type snow trap, designed by M. Mellor for gauging Antarctic drift snow at different elevation, has been presented. Extensive series of measurements made with this instrument, together with wind profile measurements, have shown that snow drift transport is much larger than previously thought. Following M. Mellor and U. Radok, snow drift transport figures hitherto regarded as true for extreme conditions only, such as wind conditions in Terre Adélie, may be regarded as representative of almost the entire coast-line of Antarctica. Drifting snow appears to be an important item in the mass budget of the Antarctic ice sheet. This conclusion must await further confirmation.

(6) *Heat and mass exchanges.* Four contributions were devoted to budget studies and transport phenomena. From available data, admittedly scanty and doubtful, it may be concluded (F. Loewe) that accumulation of ice (snowfall) in the Antarctic exceeds ablation (snow drift across the coastline and removal at the front of the ice shelf). This conclusion needs to be checked with more reliable data.

Estimates on a monthly basis of individual terms of the heat budget (effective solar radiation, outgoing long-wave radiation, heat storage in atmosphere and ocean, latent heat) of 5° latitude zones from 40° to 90° S. were presented (J. F. Gabites). The southward transport of heat to maintain balance appears to be little higher than at corresponding northern latitudes; the meridional heat flux reaches, in winter and early spring, a maximum value of over 5×10^{10} cal./day, cm., of latitude circle in the latitude belt 40°–60° S. (yearly average; about $3{\cdot}7 \times 10^{10}$ cal./day, cm., in latitude 60° S.).

In the upper troposphere, cyclonic circulation may exist throughout the year, reaching the 300 mb. level before winter solstice (June 1958) and the 500 mb. level before summer solstice (December 1958), with variable intensity of inflow at high levels and outflow at low levels. Meteorological conditions are strongly influenced by meridional advection along the coastline. Surface conditions, including advection, vary considerably from month to month and from year to year (M. J. Rubin).

The winter thermal structure of the Antarctic stratosphere is primarily controlled by infra-red radiation processes (W. B. Moreland). Dynamic processes, such as advection and vertical motion, are of much less importance in the Antarctic than in the Arctic stratosphere. The Antarctic cyclonic polar vortex in winter seems to be much more stable than the corresponding Arctic polar vortex. The spring maximum of ozone content observed in November (1958) at "Little America V" seems to be related to circulation changes in the stratosphere. Ozone measurements in "Little America V" are in accordance with the Halley Bay measurements (J. MacDowall). Maximum amounts of ozone are also observed in Halley Bay in November, that is to say 2–3 months after the seasonal maximum in northern latitudes (February–March). Moreover the highest values observed in the high southern latitudes are lower than in the corresponding northern latitudes. Ozone ascents in Halley Bay (1957–58) have shown that the first increase in ozone content occurs at the tropopause level, that the ozone layer moves down from winter to summer, and that the summer values are lower than the winter values.

(7) *Climatological aspects.* Detailed local climatological studies were presented in the form of notes on the climatology of "Wilkes" station (J. R. Zimmerman), of Halley Bay (J. MacDowell), of the South American Antarctic sector (W. Schwerdtfeger, L. M. de la Canal and J. Scholten), and of "Dumont d'Urville" and Port-Martin stations (B. Valtat). Such local studies are not particularly important of course from the practical point of view, but are essential to the understanding of meso, and large-scale, processes. Two important contributions were made to the upper air climatology, namely, a preliminary note on mean monthly pole-to-pole cross sections of the tempera-

ture field near 170° E., for 1957, showing some marked thermal asymmetries between the two hemispheres (R. C. Taylor); and a climatography of the atmosphere above the South Pole during 1957 from the surface to the 50 mb. level, pointing out some peculiar surface conditions and the difference in behaviour between the stratosphere and the troposphere regarding the seasonal temperature changes.

Differences in temperature changes in the surface layer (kernlose winter), the troposphere (yearly temperature change of 10° C.) and the stratosphere (yearly temperature change of 50–60° C.) over Antarctica were tentatively explained (H. Wexler), and the main difference between the abrupt warming in the Arctic (30°–40° C., 6 weeks before spring equinox) and Antarctic stratosphere (50° C., in 1 month after spring equinox) was demonstrated. A secular trend of temperature since 1912 of +2·6° C. at "Little America V" (78° 12′ S., 162° 15′ W.) is compared with a 6·2° C. trend at Spitzbergen (78° 04′ N., 13° 38′ E.). Finally the effect of downward cloud radiation on surface temperature was shown.

A preliminary analysis of wind measurements made by a new constant level balloon technique (V. O. Hopper and J. E. Laby) during the WMI's at lat. 38° S. showed no reversal above 25 km., from east wind in summer to west wind in winter. The importance of global wind studies in the 30 km. layer was stressed.

Antarctic meteorology shows the considerable enrichment of meteorological understanding which occurs when an important gap of the observing network has been filled. This particular enrichment must be put on the IGY credit.

Meteorologists will be grateful to the Director of the Commonwealth Bureau of Meteorology and to their colleagues in Melbourne for the great care they have taken in publishing the contributions presented during the symposium and the discussions which took place at the end of each session.

Satellite studies over the Southern Ocean

The above review by Professor Van Mieghem stresses the difficulties of meteorological analysis over southern oceans in the absence of a reasonably spaced observational network. The successful launching and operation of the meteorological satellites Tiros I and Tiros II, since the symposium on Antarctic Meteorology was held in Melbourne, has provided a new type of observational material which is not covered by the volume on Antarctic meteorology. The secretary of the SCAR permanent working group on meteorology (W. J. Gibbs) was asked to provide information of interest to readers of *SCAR Bulletin* on this new technique. H. Phillpot, the officer-in-charge of the International Antarctic Analysis Centre in Melbourne has adapted an article by G. T. Rutherford published in the *Australian Meteorological Magazine*, No. 32, March 1961, for this purpose.

The Fourth Meeting of SCAR drew attention to the increased knowledge to be gained from satellite studies of cloud and pack ice cover in Antarctic

and sub-Antarctic regions, and asked that arrangements should be made to distribute the results of the analyses of such data for operational and research purposes. An effective arrangement has clearly been put into operation between the United States and the Australian Commonwealth Bureau of Meteorology. Although the studies covered by the following article barely reach as far south as the Antarctic convergence, the development of the new technique is so important for Southern Ocean analyses that the article submitted has been reproduced in full, even though it stretches northwards to cover sub-tropical cyclones. Some of the difficulties in adapting the technique to the study of pack ice distribution become apparent from this article, although the problem is not specifically discussed. Although the detailed meteorological problems described in the article will mainly interest meteorologists, it is believed that the general technique will interest a wide circle of scientists.

Synoptic meterological application of neph-analyses from Tiros II

BY G. T. RUTHERFORD*

Short period or 24-hour forecasting in Australia, as well as the longer range forecasts, is often difficult due to the presence of extensive ocean regions to the west and south of the continent where synoptic data is almost non-existent.

Over the 2000 miles of Indian Ocean to the west, reports are available as routine only from Amsterdam Island (38° S., 78° E.) and Îles Kerguelen (49′ S., 70° E.) roughly 1500 miles distant, and from Marion Island (47° S., 38° E.) a farther 1000 miles westward. To the south and south-west reports are available from a few stations on the Antarctic coastline, 1500 miles distant. Reports from ships are quite inadequate to bridge these gaps since the shipping lanes for the most part skirt the coastline of the Australian Bight, and ships *en route* from South African ports to Melbourne or Perth are relatively few.

Australian meteorologists therefore approach the task of analysis over the Indian and Southern Oceans with no great confidence. Such success as is achieved is a product of long experience and of the meticulous care with which the sequence of reports from each station is studied. The passage of the polar frontal systems through Marion Island, Amsterdam Island and Îles Kerguelen is closely watched by detailed study of the 3-hourly reports from these stations and linked where possible to the great depressions which skirt the 'coastline' of Antarctica.

The validity or otherwise of these analyses is frequently not evident until demonstrated by conditions some 24–36 hours later over western or southern Australia. It is abundantly evident also that a careful analysis of frontal systems in the Amsterdam Island and Îles Kerguelen region is not necessarily

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adequate for forecasts over southern Australia. Information is generally lacking concerning the development of waves on fronts in the region between Amsterdam Island and the west Australian coast. Even in the southern areas of the Australian Bight cyclogenesis has occurred unexpectedly on not infrequent occasions with resultant forecast failures in the south-eastern States. A major factor here is perhaps the frequency of occurrence of jet maxima at latitudes south of the continent with consequent uncertainty of analyses at upper levels.

It can be seen from the foregoing that the introduction of an aid such as cloud photographs from artificial satellites is an epoch-making event in Australian and world meteorology. The location of significant cloud patterns over the oceans has application not only to the frontal systems affecting southern Australia but with equal importance also to the detection and tracking of tropical cyclones.

The ultimate aim of cloud photography from satellites is to locate significant synoptic patterns over the earth's surface and particularly over the oceans. It is not certain at this stage how far this conception may be extended to the point where particular cloud patterns on photographs may be recognized as 'models' which may be immediately associated with various types of fronts, or whether absence of cloud or the presence of strato-cumulus cloud may be associated with regions such as the forward or rear portions of anticyclones. However it is already evident that the major rain and wind systems in both tropical and extra-tropical regions have in many cases characteristically significant cloud features on satellite photographs. These features are the spiralling cumuliform lines and the well-defined vortex.

It is reasonable to expect that accuracy in synoptic analysis over oceanic regions will depend on the extent to which these models may be applied and to the experience which has been acquired in interpretation of the cloud photographs both as regards patterns of cloud and cloud types.

A project, designed to gain experience in interpretation from satellite neph-analyses, was carried out by the Australian Bureau of Meteorology at the invitation of the National Aeronautics and Space Administration and the United States Weather Bureau during observations with the meteorological satellite Tiros II.

The Tiros II artificial weather satellite was an 18-sided polygon, shaped like a pill box, with dimensions of 42 in. diameter by 19 in. height, weighing 280 lb. and powered primarily by solar cells.

The satellite was launched on 23 November 1960 and achieved its objective of a roughly circular orbit with an altitude of about 400 miles. The period of rotation of such an orbit around the earth is 98 minutes and the satellite speed about 17,000 miles per hour. Tiros II was spin-stabilized.

It was equipped with two television cameras designed to photograph the earth's cloud cover during daylight conditions. These cameras were different in coverage and resolution. The camera axes were parallel to the spin axis, which was in general not normal to the earth's surface. On those occasions when the spin axis and the camera were pointing downwards towards the

centre of the earth (zero nadir angle) the wide-angle camera viewed an area approximately 750 miles on a side with a resolution of 1·5–2 miles; the narrow-angle camera viewed an area approximately 75 miles on a side in the zero nadir angle position but with resolution of about 0·15–0·2 mile. When the camera was looking at higher nadir angles the extent of the coverage was increased while the resolution decreased.

The command and data acquisition centres were located at Belmar, New Jersey and San Nicolas Island, California. When the satellite was on orbit within a certain range of either of these stations, instructions were issued to the cameras to take pictures at a specific future time and to store them in a magnetic tape recorder. The pictures were read out at the next orbital pass within range of the data acquisition station, recorded on tape and in parallel on film by photography of a monitor screen.

It was not practicable to obtain transmission to Australia of the actual satellite photographs. However the United States Meteorological Satellite Laboratory was most co-operative in the despatch of coded neph-analyses as interpreted from the photographs. These coded messages which indicated areas of overcast, broken or scattered cloud and clear sky were received by teletype at Central Analysis Office, Melbourne, in some cases as early as four hours after satellite photograph time.

The function of the Central Analyses Office in this experiment was to identify particular areas of interest coincident with satellite orbits and to request photographs where practicable in relation to solar illumination. Decisions as to practicability in regard to programming requirements and to camera orientation were made by the U.S. Weather Bureau. The extent to which the Australian requests were met was most gratifying. A large number of neph-analyses were, in fact, forwarded without specific request on a routine basis and these will be the subject of exhaustive study and correlation with Australian analyses over ocean regions to the west and south of the continent. In the meantime several situations have been selected for preliminary discussion below.

(*a*) *Cessation of heat wave conditions over south-east Australia*

The most prolonged heat wave in December for forty-three years persisted over south-east Australia from 24–31 December 1960 with temperatures exceeding 100° F (38° C) daily in most districts.

The heat wave was associated with a blocking high over the Tasman Sea. The "block" was typically represented on upper charts although not in the classical sense of a zonal flow upstream splitting into two westerly branches with approximately equal mass transport north of the upper cold low and south of the warm high. Nevertheless, the Tasman anticyclone at M.S.L. remained blocking from 25–30 December 1960 when it commenced to move eastward and lose intensity.

There was no evidence of any strong jet upstream nor any indications (having regard to the subjectivity of the analysis) of strong shear or curvature changes in the Australian Bight. In any event, a wave which formed on the

front west of Tasmania during 29 December 1960 moved slowly eastward without deepening. This cool change moved over the Victoria coast on 31 December 1960, accompanied by a fall in temperature of 25–30° F.

A neph-analysis obtained by Tiros II at 0257 Z, 29 December 1960, indicated a belt of overcast cloud orientated from north-west to south-east. The 0600 Z Southern Ocean analysis for this date (as analysed without reference to the satellite picture) indicated a front with similar orientation. The location of the front on the analysis was arrived at largely by historical extrapolation over Southern Ocean waters from Amsterdam and Îles Kerguelen reports, together with indications of frontal passage through stations along the southern coastline of the continent.

The satellite neph-analysis implied that the front was located further east along lat. 40° S. than analysed. This was largely substantiated later when the cool change moved into southern Tasmania earlier than anticipated.

However there are difficulties in interpreting these neph-analyses. In this case, although the satellite picture appeared to call for the amendment of the analysis, only scattered cloud was reported from stations in southern Tasmania at the time of the satellite photograph, which had been interpreted to show overcast conditions in this region. Also it was to be expected that the cold centre of the occluded cyclone would be associated with overcast cloud, but in the neph-analysis clear skies were reported. The centre of the cold low was definable with some precision in the isobaric analysis on this occasion due to the observation from the ship *Magga Dan, en route* with the 1961 expedition to Antarctica. The *Magga Dan* reported heavy overcast conditions in the vicinity of 55° S., 130° E.

These apparent inconsistencies perhaps highlight a factor which must be considered in the interpretation of the neph-analyses from Tiros II, i.e. the translation picture boundary error of about ± 2 or 3 degrees of latitude.

An interesting feature associated with this particular case concerned the belt of overcast cloud which was lying roughly parallel to the front. This cloud was located, as far as could be ascertained, ahead of the surface frontal boundary (allowing also for the time difference between the isobaric—and neph-analyses) and at 0257 Z, 29 December 1960, was pictured as almost entering the continent along the coastal fringe to the south-east. The speed of the front at these latitudes was about 12 knots towards the east. Nevertheless, overcast conditions did not become apparent over the southern states at any time during the following 48 hours until almost immediately prior to the cool change, when skies became overcast due to rapidly developing cumulo-nimbus.

The translational error could hardly have been responsible in this case for such delay in appearance of an overcast cloud region of largely frontal origin. On the other hand, the neph-analysis indicating, perhaps significantly, "overcast" instead of "heavy overcast" may well have been the interpretation of photographed strato-cumulus cloud which formed in the warm northerly stream ahead of the front—a warm stream moving over a considerably cooler ocean surface. Such cloud would not be expected to form over any land

Neph-analysis frame showing an area of overcast south-west of Île Amsterdam. The central cross is on this overcast area. Île Amsterdam is in the clear band to the north-east

Cloud area in upper left is an overcast patch between lats. 25° and 35° S., and longs. 99° and 105° E. The direction from the central cross to the upper left corner is approximately south-south-east

Satellite neph-analysis photographs of an area in the vicinity of Île Amsterdam, 2 January 1961 (see p. 651-52)

Photographs: National Aeronautics and Space Administration/United States Weather Bureau

(*Facing p. 650*)

areas as the front moved slowly eastward. It seems probable that the extensive cloud formation which was photographed as preceding the front over the eastern Bight was not due primarily to frontal activity. This was supported to some extent by a "nil sferics" report in this region and to a greater degree by the subsequent observations of predominantly clear skies over land stations right up to the arrival of the cold front. The very rapid build-up of cumulus cloud to the thunderstorm stage was apparently largely triggered by diurnal heating due to prefrontal temperatures of about 100° F.

While it is not reasonable to draw general conclusions from a particular case, it is evident that interpretation will require not only familiarity with types of cloud patterns associated with various frontal systems but will re-emphasize the influence of locality, of heat and moisture exchanges and of stability on cloud formation.

(*b*) *Location of a tropical cyclone over north-east Australian waters*

By 27 December 1960 the thermal trough had become well established with east–west orientation at about 12° S. From 27 December 1960 to 2 January 1961 a few weak cyclonic circulations appeared to form in this trough. On 3 January 1961 there were indications (from "sferics" reports) of a deep moist layer in the region adjacent to the north-east Australian coast. On this date also the M.S.L. analysis for 0200Z showed a weak cyclonic circulation centred just off the Queensland coast at about 20° S.

Since an initial cyclonic circulation and a deep moist layer are two of the basic requirements for tropical cyclogenesis, the satellite pictures for 0225Z, 3 January 1961 were of particular interest. These showed three regions of "heavy overcast" cloud (the neph-analysis elsewhere within the picture boundary indicated only scattered to broken cloud over the ocean) and all of these regions coincided with positive "sferic" areas.

It was perhaps significant that at 2000Z, 3 January 1961, the cyclonic centre appeared to be located farther north at 17° S., 149° E.

The Tropical Cyclone Warning Centre at Brisbane subsequently issued cyclone warnings as the disturbance moved east to south-east, away from the continent, with only slight intensification prior to its filling by 7 January 1961. No further satellite pictures were available.

This case is an example of accurate determinations of regions of heavy overcast cloud and augurs well for detection of cyclones by satellite photographs.

(*c*) *Frontal analysis over the Indian Ocean*

The analysis over the Indian Ocean area in the vicinity of reporting stations at Amsterdam and Îles Kerguelen is often capable of some objectivity. On other occasions, however, the nature of the frontal passages is obscure and the analysis cannot be uniquely determined.

An example of such a situation occurred on 2 January 1961 when the satellite neph-analysis showed an area of "overcast" south-west of Amsterdam Island. This could be much more satisfactorily explained on the frontal

analysis by advancing an occluded front some 400 miles farther east of the position originally postulated.

This case is typical of the application of many satellite pictures to the Île Amsterdam—Îles Kerguelen area.

However, once again this example illustrates the difficulty encountered in satisfactorily interpreting satellite data, because an area of "overcast" was observed between lats. 25° and 35° S. and longs. 99° and 105° E. This was supported by two ship reports—one of which also reported showers, but whilst it was probable that this activity was the result of convergence in a trough extending southward from a cyclone centred further to the north, no frontal interpretation could be presented.

(*d*) *Location of fronts and convective cloud over the Australian continent*

On 31 December 1960, it was necessary to move an occluded frontal system some 300 miles farther east to obtain consistency between the neph- and frontal analyses.

The location of the northern cold front was confirmed as lying just inland from the Australian Bight. The "heavy overcast with breaks" confirmed the widespread reports from ground observers of convective thunderstorm activity in a trough over Queensland.

This example emphasizes the uses of the satellite pictures for forecasting over settled areas. At a glance the forecaster can form an opinion as to the probable duration of rain from the width of the frontal cloud band. Also the widespread nature of convective storms can be much better appreciated through the camera eye than through the reports of sometimes widely distant ground observers.

(*e*) *Location of an extra-tropical vortex over the Indian Ocean*

As stated above, one of the three synoptic reporting stations in the South Indian Ocean is Marion Island. In the 36-hour period preceding 0600Z, 18 December 1960, there was strong ionospheric activity which caused a "blackout" of radio transmissions of weather reports from this particular station. During this period the 0600Z M.S.L. analysis for the Southern Ocean was completed for the Marion Island region by extrapolation but this was necessarily highly subjective since it was taken from the far south-west Indian Ocean, a region where analysis cannot be done with confidence from Australia. When the neph-analysis was obtained it indicated a cloud area containing a vortex and spiralling cumuliform clouds in a region where a ridge of high pressure had been indicated. The Southern Ocean analysis was accordingly amended to indicate a strong circulation about an occluded low centred at the vortex. The subsequent history of frontal passage through Amsterdam Island verified the existence of the low in the general locality indicated by the picture.

This is an example of the magnitude of errors which can be made in analysis over ocean regions. In this case the error was due to the absence of reports from Marion Island, through or near which the low must have passed during

the "blackout" period. However, the potential value of satellite photographs can be gauged when it is appreciated that for Australian meteorologists wide regions of the Indian and Southern Oceans are in a condition approaching a permanent "blackout".

(*f*) *Cases presenting apparent inconsistencies*

Although specific cases of inconsistency will not be discussed here in detail, reference should be made to neph-analyses which have not lent themselves readily to interpretation. This may be due largely to a newly-found inadequacy of appreciation of the various conditions, other than frontal, under which clouds may occur over ocean regions.

However, neph-analyses over the continent on some occasions appeared inconsistent with ground observations of cloud (e.g. neph-analysis of 0510Z, 30 December 1960, when clear skies reported by neph-analysis appeared at variance with broken cloud reported by observers). Also the location of the vortex referred to under (*e*) did not fit, as well as expected, the mutually consistent observations of two whaling ships in the locality. In this regard the picture translation error may have been an important consideration.

In considering such cases also regard must be taken of the NASA News Release Statement of 6 December 1960 to the effect that only 5–10 per cent of wide-angle pictures were meteorologically useful. (The decision of the Bureau of Meteorology to request wide-angle pictures was based on an expectation of limited access to programmes and the greater likelihood of coverage of a particular area of interest with a camera whose picture frame was of the order of 750 miles in width as against 75 miles for a narrow-angle camera.) 'Meteorological usefulness' of satellite pictures is a relative quality which must be considered in relation to availability of data from other sources. It cannot be doubted that over our ocean regions, a very large proportion of the wide-angle pictures were useful to Australian meteorologists.

From this study it will be seen that some of the neph-analyses obtained from Tiros II have provided general confirmation of the conventional analyses of the Southern Ocean areas prepared in the Commonwealth Bureau of Meteorology, some have presented features which have called for re-analysis in a manner which has been verified by later history, whilst some which have not lent themselves to ready interpretation will require further study. A few have apparently been at variance with observations.

Interpretation of neph-analyses or cloud photographs for use in analysis will involve not only a study of cloud patterns for models to be associated with various types of fronts and cyclonic vortex-spiral systems, but also an attempt to identify the types of cloud represented and the nature of the cloud producing mechanism, i.e. whether fronts, convergence, turbulence or convection. The utility of satellite cloud photographs is likely not only to have far-reaching and scarcely foreseeable effects on extended range and day to day forecasting in Australia, but for organizations like the International Antarctic Analysis Centre offers very great potential benefits indeed. However, it is again emphasized that the interpretation of the data must be more thoroughly

understood and this can only be achieved in the Centre if adequate professional staff is available to undertake the essential investigatory work.

In the Bureau of Meteorology the opportunity of participating in the Tiros II experiments has laid the groundwork to this end.

Science in Antarctica

In *SCAR Bulletin*, No. 7, 1961, there appeared, as an appendix to the report on the Fourth Meeting of SCAR, an "Assessment of the progress of Antarctic research during 1959–60". The United States Committee on Polar Research of the National Academy of Sciences has recently produced a work which forms a valuable supplement and amplification to this in *Science in Antarctica* (Publication 839, National Academy of Sciences—National Research Council, 1961, Washington).

It is published in two parts, "The life sciences in Antarctica" and "The physical sciences in Antarctica" and its aims are set out by Dr Lawrence Gould in the Foreword: (1) to outline promising areas of scientific research in the Antarctic; (2) to indicate the value and interest of Antarctic studies to scientists throughout the nation: and (3) to suggest the general importance of the United States Antarctic Research Program as a national effort.

The Committee has drawn on leading scientists in the United States to write individual chapters, in each of which the present state of knowledge in a particular discipline is outlined, and the possibilities of future developments of research in that field are discussed. The length of the individual chapters, excluding the useful bibliographies at the end of each one, varies from two pages on "General ecology and physiology of Antarctic fish" to sixteen pages on "Antarctic glaciology".

Part 1, "The life sciences in Antarctica" contains chapters on fossil plants, lichens, bryophytes, freshwater and marine algae, insects and other land anthropods, seals, whales, fish, birds, invertebrates, microbiology and man. Part 2, "The physical sciences in Antarctica" is divided into three sections; Heat and water budget in Antarctica; Earth's crust and core; and The upper atmosphere. It is of interest to note that Part 1 covers 162 pages compared to the 131 pages in Part 2. This is partly due to more detailed bibliographies in the former, but it also indicates the increased emphasis which the Committee on Polar Research would like to place on biological disciplines, which received little support during the IGY. Geological disciplines and cartography, also omitted from the IGY programme, are similarly recommended as fields for special future study.

The distribution of such reports outlining views of leading scientists on promising lines of research is in keeping with the best traditions of science, and the general atmosphere of international scientific co-operation now prevailing in matters of Antarctic interest. A copy of the report has been sent to the SCAR delegate in each member-country and others, and a limited number of copies are available from the National Academy of Sciences, Washington, at $1.50 for each of the two parts.

Stations occupied in the Antarctic, Winter 1961

[Stations marked * are north of lat. 60° S.]

Argentina

"Decepción", lat. 62° 59′ S., long. 60° 43′ W.
"Melchior", lat. 64° 20′ S., long. 62° 59′ W.
"General Belgrano", lat. 77° 58′ S., long. 38° 48′ W.
"Esperanza", lat. 63° 23′ S., long. 56° 59′ W.
"Orcadas", lat. 60° 45′ S., long. 44° 43′ W.
"Teniente Matienza", lat. 64° 58′ S., long. 60° 03′ W.
"Ellsworth", lat. 77° 43′ S., long. 41° 07′ W.

Australia

*Macquarie Island, lat. 54° 30′ S., long. 158° 57′ E.
Mawson, lat. 67° 36′ S., long. 62° 53′ E.
Davis, lat. 68° 34′ S., long. 77° 57′ E.
"Wilkes", lat. 66° 15′ S., long. 110° 31′ E.

Chile

"Arturo Prat", lat. 62° 29′ S., long. 59° 38′ W.
"Pedro Aguirre Cerda", lat. 62° 56′ S., long. 60° 36′ W.
"General Bernardo O'Higgins", lat. 63° 19′ S., long. 59° 38′ W.
"Presidente Gabriel Gonzalez Videla", lat. 64° 49′ S., long. 62° 51′ W.

France

*"Camp Heurtin", lat. 37° 50′ S., long. 77° 34′ E.
*Port aux Français, lat. 49° 21′ S., long. 70° 12′ E.
"Dumont d'Urville", lat. 66° 40′ S., long. 140° 01′ E.

Japan

"Syowa", lat. 69° S., long. 39° 35′ E.

New Zealand

"Scott", lat. 77° 51′ S., long. 166° 48′ E.

New Zealand/United States

"Hallett", lat. 72° 18′ S., long. 170° 18′ E.

South Africa

*Marion Island, lat. 46° 53′ S., long. 37° 52′ E.
*Tristan da Cunha, lat. 37° 03′ S., long. 12° 19′ W.
*Gough Island, lat. 40° 19′ S., long. 9° 51′ W.
"Norway station", lat. 70° 30′ S., long. 2° 52′ W.

United Kingdom

Port Lockroy (Base A), lat. 64° 50′ S., long. 63° 31′ W.
Deception Island (Base B), lat. 62° 59′ S., long. 60° 34′ W.
Hope Bay (Base D), lat. 63° 24′ S., long. 56° 59′ W.
Stonington Island (Base E), lat. 68° 11′ S., long. 67° 00′ W.
Fossil Bluff, lat. 71° 20′ S., long. 68° 17′ W.
Argentine Islands (Base F), lat. 65° 15′ S., long. 64° 15′ W.
Signy Island (Base H), lat. 60° 43′ S., long. 45° 36′ W.
Adelaide Island (Base T), lat. 67° 46′ S., long. 68° 54′ W.
View Point (Base V), lat. 63° 32′ S., long. 57° 23′ W.
Halley Bay (Base Z), lat. 75° 31′ S., long. 26° 36′ W.
*South Georgia, lat. 54° 17′ S., long. 36° 30′ W.

United States

"Amundsen–Scott", South Geographical Pole.
"Byrd", lat. 79° 59′ S., long. 120° 01′ W.
McMurdo Sound, lat. 77° 51′ S., long. 166° 37′ E.

Union of Soviet Socialist Republics

Mirny, lat. 66° 33′ S., long. 93° 00′ E.
"Vostok", lat. 78° 27′ S., long. 106° 52′ E.
"Novolazarevskaya", lat. 70° 45′ S., long. 11° 58′ E.

Exchange of foreign observers in the Antarctic, 1960–61

Name	Country of origin	Occupation	Host country
W/C W. Addison, R.A.A.F.	Australia	Pilot	Argentina
Capt. M. P. Bamman	Australia	Aeronaut	United States
J. P. van Bellinghen	Belgium	Economist	United States
Rear-Admiral R. B. Black, U.S.N. Retd.	United States	Operations research analyst	Belgium
W. L. Boxell	United States	Hydrographer	Japan
A. de Cailleux	France	Geologist	United States
Lt.-Col. H. Danyau	Chile	Army Officer	United States
H. M. Dater	United States	Historian	Argentina
J. W. Finklang	United States	Geodesist	U.S.S.R.
J. R. Hays	United States	Geographer	Australia
L. Kuperov	U.S.S.R.	Physicist	United States
Lt. N. D. A. Lopez	Argentina	Oceanographer	United States
Comm. C. J. F. Netterberg, S.A.N.	South Africa	Naval Officer	United States
R. M. O'Hagan	United States	Oceanographer	South Africa
B. B. Roberts	United Kingdom	Ornithologist	United States
R. J. Villela	Brazil	Oceanographer	United States
W. W. Watkins	United States	Polar test officer	France

RECENT POLAR LITERATURE

This selected bibliography has been prepared by R. J. Adie, Julia Allen, T. E. Armstrong, Diana Beddow, Joan Blake, Sylva Gethin, J. W. Glen, H. G. R. King and B. B. Roberts. Its main field is the polar regions, but it also includes other related subjects such as "applied" glaciology (e.g. snow ploughs and ice engineering). For the literature on the scientific study of snow and ice and of their effects on the earth, readers should consult the bibliographies in each issue of the *Journal of Glaciology*. For Russian material, the system of transliteration used is that agreed by the U.S. Board on Geographic Names and the Permanent Committee on Geographical Names for British Official Use in 1947 (see *Polar Record*, Vol. 6, No. 44, 1952, p. 546).

Reprints of "Recent Polar Literature", from Nos. 37/38 onwards, can be obtained separately (to allow references to be cut out for pasting on index cards) from the Institute, price 2*s*. 6*d*. for two prints. Copies will be sent without charge to organizations with which the Institute maintains exchange arrangements and which notify their wish to receive them. Readers can greatly assist by sending copies of their publications to the library of the Institute.

To increase the usefulness of the bibliography entries have been arranged provisionally under subject headings in classified order according to the Universal Decimal Classification.

LIST OF SUBJECT HEADINGS

BIBLIOGRAPHICAL SCIENCE AND TECHNIQUE

ROBERTS, BRIAN BIRLEY. The organization of polar information. *Scott Polar Research Institute Occasional Paper*, No. 1, 1960, 17 p. [Problems encountered by Institute library discussed from the point of view of international co-operative documentation.]

RELIGION. THEOLOGY

DOLGIKH, B. O. Prineseniye v zhertvu oleney u nganasan i entsev [Sacrifice of deer among Nganasany and Entsy]. *Akademiya Nauk SSSR. Institut Etnografii imeni N. N. Miklukho-Maklaya. Kratkiye Soobshcheniya* [*Academy of Sciences of the U.S.S.R. N. N. Mikluko-Maklay Institute of Ethnography. Short Communications*], No. 33, 1960, p. 72–81. [Details of ceremonies.]

ALEKSEYENKO, YE. A. Kul't medvedya u ketov [Cult of the bear among the Kety]. *Sovetskaya Etnografiya* [*Soviet Ethnography*], 1960, No. 4, p. 90–104, illus. [Former religious significance of annual 'bear festival'.]

NATIVE PEOPLES

CHARD, CHESTER S. Routes to Bering Strait. *American Antiquity*, Vol. 26, No. 2, 1960, p. 283–85, map. [Possible routes of human migration from north-east Asia to north-west North America.]

RASMUSSEN, KNUD. Knud Rasmussen og Thule. *Grønland*, 1961, Nr. 1, p. 24–26. [Draft of Knud Rasmussen's first report after establishment of trading station at Thule, north-west Greenland.]

DOLGIKH, BORIS OSIPOVICH. Rodovoy i plemennoy sostav narodov Sibiri v XVII v. [Clan and tribal structure of the peoples of Siberia in the 17th century]. *Trudy Instituta Etnografii imeni N. N. Miklukho-Maklaya. Novaya Seriya* [*Transactions of the N. N. Miklukho-Maklay Institute of Ethnography. New Series*], Tom 55, 1960, 622 p., maps. [Numbers and distribution of Siberian natives on arrival of Russians.]

GURVICH, I. S. Sovremennyye etnicheskiye protsessy, protekayushchiye na severe Yakutii [Present day ethnic processes functioning in the north of Yakutiya]. *Sovetskaya Etnografiya* [*Soviet Ethnography*], 1960, No. 5, p. 3–11. [Merging of tribal groups.]

TERRITORIAL CLAIMS

HAYTON, ROBERT D. The nations and Antarctica. *Österreichische Zeitschrift für Öffentliches Recht*, Bd. 10, Hft. 3–4, 1960, p. 368–412, map. [Summary history of exploration by various nations and the basis of their claims to Antarctic territory.]

PUIG, JUAN CARLOS. *La Antártida argentina ante el derecho*. Buenos Aires, Roque Depalma, 1960. xii, 274 p., maps. 22 cm. [Part 1. General exposition of principles of polar sovereignty, and possible solutions of Antarctic problem. Part 2. Argentine, Chilean, British and United States claims.]

HANESSIAN, JOHN, *jr.* The Antarctic Treaty 1959. *International and Comparative Law Quarterly*, Vol. 9, 1960, p. 436–80. [Discussion of treaty signed at Washington, D.C., December 1959, and events leading up to it.]

MOLODTSOV, S. V. Dogovor ob Antarktike [Treaty on the Antarctic]. *Sovetskoye Gosudarstvo i Pravo* [*Soviet State and Law*], 1960, No. 5, p. 64–72. [Soviet comments on Antarctic Treaty, 1959.]

[ANTARCTICA : TREATIES] [*A bill for an act to give effect to the Antarctic Treaty.*] Canberra, Commonwealth Government Printer, 1960. [6] p. 27 cm. [Antarctic Treaty Act, 1960.]

MILITARY ART AND SCIENCE

STEEN, E. A. *Norges sjøkrig 1940–1945. Bind VII. Marinens operasjoner i arktiske farvann og i Island, på Grønland, Jan Mayen og Svalbard.* Oslo, Gyldendal, 1960. 380 p., illus., maps. 25½ cm. [Norwegian naval operations in Arctic waters and in Iceland, Greenland, Jan Mayen and Svalbard, 1940–45.]

STEPANOV, A. M., *ed. Za sovetskiy sever. K. sorokletiyu osvobozhdeniya severa ot interventov i belogvardeytsev. Sbornik dokumentov i vospominaniy* [*For the Soviet north. On the 40th anniversary of the liberation of the north from interventionists and white guards. Collected documents and reminiscences*]. Vologda, Vologodskoye Knizhnoye Izdatel'stvo [Vologda Book Publishing House], 1960. 224 p., illus. 21 cm.

BELOV, M. I. Arkticheskiy "Varyag" [An Arctic "Varyag"]. *Vodnyy Transport* [*Water Transport*], 12, 17, 19 and 21 January 1961. [Narrative of sinking of *Sibiryakov* by *Admiral Scheer* in Kara Sea, August 1942.]

ETHNOGRAPHY. CUSTOMS. FOLKLORE

VASIL'YEV, V. I., *and* TUGOLUKOV, V. A. Etnograficheskiye issledovaniya na Taymyre v 1959 godu [Ethnographic investigations in Taymyr in 1959]. *Sovetskaya Etnografiya* [*Soviet Ethnography*] 1960, No. 5, p. 128–41, illus. [Summary of studies among several native groups by field party from Institut Etnografii.]

JACOBI, HANS. Evarssuaq—en særpræget grønlandsk kvindeskikkelse. *Grønland*, 1961, Nr. 1, p. 27–34, illus. [Biographical note on a Greenlandic woman, Evarssuaq, who lived at Jakobshavn, west Greenland, 1872–1953.]

NICHOLSON, L. H. [The north and the Eskimo]. *Arctic Circular*, Vol. 13, No. 2, 1960, p. 17–22. [Outline of some aspects of Canadian Government's responsibilities toward Eskimo. Advocation of long-term policy.]

PHILLIPS, R. A. J. The opening door. *North* (Ottawa), Vol. 7, No. 6, 1960, p. 1–9, illus. [Problems of providing formal education for Canadian Eskimo.]

[CANADA] Report on the north. *Imperial Oil Review*, Vol. 44, No. 5, 1960, 37 p., illus., map. [Short articles on different aspects of life in Canadian Arctic.]

WILLMOTT, WILLIAM E. *The Eskimo community at Port Harrison P.Q.* Ottawa, Department of Northern Affairs and National Resources, Northern Co-ordination Centre, 1961. viii, 197 p., illus., maps. (NCRC–61–1.)

ROSS, W. GILLIES. The Igloolik Eskimos. *Scottish Geographical Magazine*, Vol. 76, No. 3, 1960, p. 156–63, map. [Short history of area round Foxe Basin and account of present pattern of settlement of Eskimo living there.]

OSWALT, W. H. Napaskiak, an Eskimo village in western Alaska. *Arctic Aeromedical Laboratory* (*Fort Wainwright, Alaksa*) *Technical Report* 57-23, 1961, 130 p., illus., maps. [Study of social conditions in Eskimo village free from extreme exotic influences.]

LIDEGAARD, MADS. Landet hvor eskimoer flyver i deres private flyvemaskiner. *Atuagagdliutit/Grønlandsposten*, 1960, Nr. 22, p. 14–17, illus., map. [Impressions of visit to Alaska Eskimo, 1960.]

LANTIS, MARGARET. *Eskimo childhood and interpersonal relationships. Nunivak biographies and genealogies.* Seattle, University of Washington Press, 1960. xv, [217] p., illus., tables. 22 cm. $4.75. [Studies of Alaskan Eskimo culture, Nunivak Island, Bering Sea.]

SONNENFELD, J. Changes in an Eskimo hunting technology, an introduction to implement geography. *Annals of the Association of American Geographers*, Vol. 50, No. 2, 1960, p. 172–86, table. [Discussion of advantages and deficiencies of fire-arms for Alaskan Eskimo hunters.]

VANSTONE, JAMES W. An early nineteenth-century artist in Alaska. Louis Choris and the first Kotzebue expedition. *Pacific Northwest Quarterly*, Vol. 51, No. 4, 1960, p. 145–58, illus. [Journal notes kept by Choris, 1795–1828, on expedition to Kamchatka, Kotzebue Sound and Land of the Chukchis 1815–17, leader Kotzebue. Contains notes on and drawings of Alaskan Eskimo.]

ANDERSEN, KRISTIAN LAUGE, *and others*. Physical fitness of Arctic Indians. By Kristian Lauge Andersen, Atle Bolstad, Yugve Løyning and Laurence Irving. *Journal of Applied Physiology*, Vol. 15, No. 4, 1960, p. 645–48, diagrs., tables. [Experiments on Indians from Old Crow, Yukon Territory.]

WHITAKER, IAN. First cousinhood among the northern Lapps. *Saga och Sed*, 1959, p. 142–46. [Kinship terminology and sociological aspects of cousinhood among three north Lappish groups.]

MILAN, FREDERICK A. Swedish Lappland: A brief description of the dwellings and winter-living techniques of the Swedish mountain Lapps. *Arctic Aeromedical Laboratory* (*Ladd Air Force Base, Alaska*). *Technical Report* 60–7, 1960, 16 p., illus. [Based on studies among Lapps in Jukkasjärvi, Torne Lappmark.]

RUONG, ISRAEL. Samerna som nomader och bofasta. *Samefolket*, 1961, Nr. 1, p. 6–14, illus., maps. [Development of nomadism and partial nomadism among Lapps in northern Scandinavia; legislation regarding reindeer herding Lapps in north Sweden.]

GEODESY. SURVEYING

[FALKLAND ISLANDS : SURVEYING] Falkland Islands. Field Survey. *Directorate of Overseas* (*Geodetic and Topographical*) *Surveys, Annual Report for the year ended 31st March, 1960*, p. 13–14, illus. [Notes on field survey, computing and mapping in Falkland Islands and Dependencies.]

BLAKE, PAUL. Photogrammetric mapping of the Brooks Range. *Photogrammetric Engineering*, Vol. 25, No. 5, 1959, p. 679–85, illus., map. [Description of photogrammetric operations in Alaska with emphasis on vertical and horizontal stereotriangulation problems.]

BUGAYEV, V. A. Opredeleniye vysoty stantsii Komsomol'skoy [Determining the height of "Komsomol'skaya" station]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 23, 1960, p. 24–27.

LACLAVÈRE, G., *and* FISCHER, J. C. *La représentation cartographique du relief polaire.* Paris, Ministère des Travaux Publics et des Transports, Institut Géographique National, 1960. 11 p., illus. 27 cm. (19e Congrès International de Géographie, Stockholm—August 1960.) [Proposals for standard designation of relief features in polar regions.]

PLACE-NAMES

[Antarctica : Place-names] Antarctic names approved by the Board on Geographic Names. Supplementary list no. 1. *Bulletin U.S. Antarctic Projects Officer*, Vol. 2, No. 3 Supplement, 1960, 10 p. [Additions and amendments to *Geographic names of Antarctica*, 1956.]

Markov, K. K. Gory L'va Berga [Lev Berg mountains]. *Vestnik Moskovskogo Universiteta. Seriya V. Geografiya* [*Messenger of Moscow University. Series V. Geography*], 1960, No. 6, p. 74, illus., map. [Location and description of mountains in Oates Land discovered by Soviet party in 1958.]

Dubovskoy, B. V. Novyye nazvaniya na karte Antarktidy [New names on the map of Antarctica]. *Priroda* [*Nature*], 1960, No. 7, p. 45, map. [I.G.Y. Valley and Lazarev Trench defined.]

Helm, A. S. *Supplement to the provisional gazetteer of the Ross Dependency*. Wellington, New Zealand Geographic Board, 1960. 32 leaves. 34 cm. [Includes bibliography and a descriptive outline of exploring expeditions since 1956.]

Zavatti, Silvio. I nove fogli della carta aeronautica del mondo al 1.000.000. *Rivista Aeronautica*, No. 9, 1960, p. 1415–21; No. 10, 1960, p. 1599–1606. [Historical and geographical comments on places named on U.S. world aeronautical chart of Antarctica. Scale 1:1,000,000, 1959.]

PHOTOMETRY

Hood, John M., *jr.* Environmental photometry in the Antarctic. *Journal of Geophysical Research*, Vol. 65, No. 5, 1960, p. 1527–34, illus., diagrs., tables. [Luminance data from McMurdo Sound area, 1958.]

GEOPHYSICS

Haeggblom, Lars-Erik. A thermistor thermometer which reads to the nearest 0·01° C in the field. *Meddelanden. Sveriges Meteorologiska och Hydrologiska Institut*. Serie D., Nr. 9, [1959?], 24 p., illus. [Description of instrument constructed in 1951–55 at Sveriges Meteorologiska och Hydrologiska Institut. German summary.]

Glokova, Ye. S., *and* Inozemtseva, O. I. Issledovaniye variatsiy kosmicheskikh luchey v vysokikh i srednikh shirotakh [Study of variations of cosmic rays in high and middle latitudes]. *In*: Treshnikov, A. F., *ed. Vtoraya kontinental'naya ekspeditsiya 1956–1958 gg. Nauchnyye rezul'taty* [*Second continental expedition, 1956–58. Scientific results*] (Leningrad, 1960) [numbered "9"], p. 31–49. [Variations with pressure and temperature, and in daily, 27-day, and annual cycles.]

Anderson, K. A., *and* Enemark, D. C. Observations of solar cosmic rays near the north magnetic pole. *Journal of Geophysical Research*, Vol. 65, No. 9, 1960, p. 2657–71, diagrs. [Balloon observations, July 16 to 27, 1959, Resolute Bay, Canada.]

Zommer, I. E., *and* Gayganov, A. G. O gravimetricheskikh rabotakh v Antarktide v 1957 g. [Gravimetric work in Antarctica in 1957.] *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 19, 1960, p. 39–42. [By Soviet expedition in Australian Antarctic Territory.]

Lehmann, I., *and* Ewing, M. On short-period surface waves as recorded in Copenhagen. *Geodætisk Instituts Skrifter*, 3 Række, Bd. 34, 1960, [52] p., illus., map. [Includes records of earthquake in Svalbard region, 1948.]

Davis, T. Neil, *and* Sanders, Norman K. Alaska earthquake of July 10, 1958: intensity distribution and field investigation of northern epicentral region. *Contributions of the Geophysical Institute, University of Alaska, Series A* (Reprinted from *Bulletin of Seismological Society of America*, Vol. 50, No. 2, 1960, p. 221–52.)

[U.S.S.R. : Earthquakes] *Byulleten' Seysmicheskoy Stantsii "Apatity" No. 5, Iyul'–dekabr' 1958 g.* [*Bulletin of the "Apatity" Seismic Station. No. 5, July–December 1958*] (Apatity), 1960, 83 p. [Earthquakes and microseisms recorded during period near Murmansk.]

Sytinskiy, A. D. Mikroseysmy v Mirnom i ikh svyaz' s gidrometeorologicheskimi usloviyami [Microseisms at Mirnyy and their link with hydrological and meteorological conditions]. *Seysmicheskiye issledovaniya. Sbornik statey. XII razdel programmy MGG (Seysmologiya)* [*Seismic studies. Collected papers. XII section of the I.G.Y. programme (Seismology)*]. No. 4, 1960, p. 116–32. [Includes English summary.]

Wescott, E. M., *and* Hessler, V. P. *The effect of topography and geology on telluric currents*. College, University of Alaska, Geophysical Institute, 1960. 50 leaves, illus. (Air Force Cambridge Research Center Contract No. AF19(604)-3075.)

Hessler, V. P. *Earth current activity at College, Alaska, July 1959.* College, University of Alaska, Geophysical Institute, 1960. [41] leaves, tables, diagrs. (Contract No. AF19 (604)-3075.)

Troitskaya, V. A. Osnovnyye kharakteristiki polya zemnykh tokov v Antarktike [Main characteristics of the field of earth currents in the Antarctic]. *In*: Treshnikov, A. F., *ed. Vtoryaya kontinental'naya ekspeditsiya 1956–1958 gg. Nauchnyye rezul'taty* [*Second continental expedition, 1956–58. Scientific results*] (Leningrad, 1960) [numbered "9"], p. 10–24.

Hessler, V. P. Telluric current micropulsations on Arctic Drifting Station Charlie. *Nature*, Vol. 188, No. 4750, 1960, p. 567–68, diagrs. [Oscillations of period less than 1 second.]

Driatskiy, V. M., *and others*. Razvitiye geofizicheskikh issledovaniy v Arktike za 40 let [Development of geophysical studies in the Arctic over 40 years. By V. M. Driatskiy, N. A. Milyayev, A. P. Nikol'skiy, K. K. Fedchenko]. *Problemy Arktiki i Antarktiki* [*Problems of the Arctic and Antarctic*], Vypusk 4, 1960, p. 97–110. [Soviet contributions to study of geomagnetism, cosmic rays, ionosphere and radio propagation.]

Deutsch, E. R., *and* Watkins, N. D. Direction of the geomagnetic field during the Triassic period in Siberia. *Nature*, Vol. 189, No. 4764, 1961, p. 543–45, maps, diagr.

Nagata, Takesi. *Report on geomagnetic secular variation during the period from 1955 to 1960.* Helsinki, International Association of Geomagnetism and Aeronomy, 1960. 13 p., tables, diagrs. [Summary and analysis of data from 85 magnetic observatories plus Antarctic data.]

Benioff, Hugo. Observations of geomagnetic fluctuations in the period range 0·3 to 120 seconds. *Journal of Geophysical Research*, Vol. 65, No. 5, 1960, p. 1413–22, diagrs. [Data from six stations including Reykjavík and Resolute Bay.]

McGregor, P. M. Magnetic results from Mawson, Antarctica, 1956. *Commonwealth of Australia, Department of National Development, Bureau of Mineral Resources, Geology and Geophysics Report* No. 40, 1959, [52] p., tables. [Includes description of control and operation of magnetic observatory at Mawson.]

GENERAL GEOLOGY.

See also STRATIGRAPHY, PETROLOGY, ECONOMIC GEOLOGY

Gregory, A. F., *and others*. Geological interpretation of aeromagnetic profiles from the Canadian Arctic Archipelago. By A. F. Gregory, Margaret E. Bower and L. W. Morley. *Geological Survey of Canada, Paper* 60–6, 1960, 13 p., maps, diagrs.

[Alaska : Geology] *Terrain study of the Exercise Little Bear area, central Copper River basin, Alaska*, Washington, D.C., Chief of Engineers Department of the Army, 1959. [74] p., illus., maps (in end pocket). 33½ cm. (Engineer Intelligence Study No. 258.) [Terrain features, geology, vegetation described; suitability for military manoeuvres evaluated.]

Holtedahl, Olaf, *ed.* Geology of Norway. *Norges Geologiske Undersøkelse*, 1960, Nr. 208, 540 p., illus., maps (plates in separate folder). [Geological structure and history of Norway.]

[Antarctica : Geology] Reports of Antarctic geological observations 1956–1960. *I.G.Y. Glaciological Report*, No. 4, 1961, xvi, 219 p., illus., maps, tables. [Collected papers.]

Matthews, Drummond H. Aspects of the geology of the Scotia Arc. *Geological Magazine*, Vol. 95, No. 6, 1958, p. 425–41, maps, tables.

Ravich, M. G. Predvaritel'nyye rezul'taty geologicheskoy s"yemki rayona oazisa Banger-Khils [Preliminary results of geological survey of the Bunger Hills region]. *In*: Treshnikov, A. F., *ed. Vtoraya kontinental'naya ekspeditsiya 1956–1958 gg. Nauchnyye rezul'taty* [*Second continental expedition, 1956–58. Scientific results*] (Leningrad, 1960) [numbered "9"], p. 171–84. [Queen Mary Land.]

Voronov, P. S., *and* Klimov, L. V. Geologicheskoye stroyeniye rayona Mirnogo [Geological structure of the Mirnyy region]. *In*: Treshnikov, A. F., *ed. Vtoraya kontinental'naya ekspeditsiya 1956–1958 gg. Nauchnyye rezul'taty* [*Second continental expedition, 1956–58. Scientific results*] (Leningrad, 1960) [numbered "9"], p. 185–96. [Queen Mary Land.]

McKelvey, B. C., *and* Webb, P. N. Geological reconnaissance in Victoria Land, Antarctica. *Nature*, Vol. 189, No. 4764, 1961, p. 545–47, maps. [Investigation of 2,500 square miles of ice-free terrain west of McMurdo Sound.]

Lisitsyn, A. P. Morskiye geologicheskiye issledovaniya [Marine geological studies]. *In*: Maksimov, I. V., *ed. Vtoraya morskaya ekspeditsiya na d/e "Ob'", 1956–1957 gg. Nauchnyye resul'taty* [*Second marine expedition in the Diesel-electric ship Ob', 1956–57. Scientific results*] (Leningrad, 1960), [numbered "7"], p. 7–43, maps. [Bottom samples from south Indian Ocean.]

Demenitskaya, R. M. Glavnyye cherty stroyeniya zemnoy kory v Antarktike [Main features of the structure of the earth's crust in the Antarctic.]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 23, 1960, p. 10–14, map.

Evison, F. F., *and others*. Thickness of the earth's crust in Antarctica and the surrounding oceans. By F. F. Evison, C. E. Ingham, R. H. Orr and J. H. LeFort. *Geophysical Journal of the Royal Astronomical Society*, Vol. 3, No. 3, 1960, p. 289, 306, map, tables, diagrs. [Analysis of 8 earthquake records.]

Karpov, N. N. Sledy poslelednikovykh tektonicheskikh razlomov v Khibinskikh gorakh [Traces of post-glacial tectonic fractures in Khibinskiye Gory]. *Vestnik Moskovskogo Universiteta. Seriya V. Geografiya* [*Messenger of Moscow University. Series V. Geography*], 1960, No. 4, p. 61, map.

Rikhter, G. D. Protsessy denudatsii v Antarktike [Denudation processes in Antarctica]. *In*: Maksimov, I. V., *ed. Vtoraya morskaya ekspeditsiya na d/e "Ob'", 1956–1957 gg. Nauchnyye rezul'taty* [*Second marine expedition in the Diesel-electric ship Ob', 1956–57. Scientific results*] (Leningrad, 1960), [numbered "7"], p. 73–84, illus. [Observations on exposed rock, mainly in Bunger Hills.]

Aubert de la Rue, Edgar. Phénomènes périglaciaires et actions éoliennes aux Iles de Kerguelen. *Mémoirs de l'Institut Scientifique de Madagascar*, Series D, Tome 9, 1959, p. 1–21, illus. [Periglacial phenomena and action of wind erosion largely obliterated by ravages of rabbits introduced in 1874.]

Henoch, W. E. S. String-bogs in the Arctic 400 miles north of the tree-line. *Geographical Journal*, Vol. 26, Part 3, 1960, p. 335–39, illus., map. [Description of string-bogs, their origin and distribution in Northwest Territories. Proposal of new name "finger print-bogs" for types of string-bog found in permafrost areas.]

GLACIOLOGY

Shumskiy, P. A., *ed. Vtoraya kontinental'naya ekspeditsiya 1956–1958 gg. Glyatsiologicheskiye issledovaniya* [*Second continental expedition, 1956–58. Glaciological studies*]. Leningrad, Izdatel'stvo "Morskoy Transport" ["Morskoy Transport" publishing House], 1960. 366 p., illus., maps. 27 cm. [Numbered "10".] [Collected papers on all aspects of Soviet glaciological work in Antarctica.]

Stacey, J. S. A prototype hotpoint for thermal boring on the Athabaska glacier. *Journal of Glaciology*, Vol. 3, No. 28, 1960, p. 783–88, illus.

Avgevich, V. I. O metodike ispol'zovaniya aerofotosnimkov pri opredelenii skorostey dvizheniya poverkhnosti l'da v lednikakh [Method of using air photographs to determine velocity of surface ice of glaciers]. *Izvestiya Vysshikh Uchebnykh Zavedeniy. Razdel Geodeziya i Aerofotos"yemka* [*News of Higher Educational Establishments. Geodesy and Air Survey Section*], 1960, Vypusk 4, p. 69–78. [Use of this method by Soviet Antarctic expeditions near "Oazis" station in 1956–57.]

Peschanskiy, I. S. Morskiye arkticheskiye i antarkticheskiye l'dy [Arctic and Antarctic sea ice]. *Problemy Arktiki i Antarktiki* [*Problems of the Arctic and Antarctic*], Vypusk 4, 1960, p. 111–29, illus. [Work on physical amd mechanical properties of floating ice carried out in Arctic and Antarctic Institute, Leningrad since 1945.]

Picciotto, E., *and others*. Isotopic composition and temperature of formation of Antarctic snows. By E. Picciotto, X. de Maere [d'Aertrycke] and I. Friedman. *Nature*, Vol. 187, No. 4740, 1960, p. 857–59, diagrs. [Variations in isotopic composition of hydrogen contained in snow samples from King Baudoin Base, lat. 79° 26′ S., long. 24° 19′ E., 1958.]

Durynin, Yu. F. Primeneniye ul'trazvukovogo metoda dlya izucheniya ledyanogo pokrova Antarktidy [Use of supersonic method for study of the ice cover of Antarctica]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 23, 1960, p. 20–23. [Laboratory method for studying elastic properties.]

Graystone, Peter. "In situ" strength tests on sea ice of low salinity, near Churchill, Manitoba. *Canada, Defence Research Board, Defence Research Northern Laboratory, DRNL Report* No. 1/60, 1960, 74 leaves, illus., tables, diagrs. [Includes meteorological data for January–April 1959 and temperature, salinity, specific gravity and crystal structure profiles of ice sheet.]

Yevteyev, S. A. O strukture antarkticheskogo lednikovogo pokrova [Structure of the Antarctic ice sheet]. *Glyatsiologicheskiye issledovaniya. Sbornik statey. IX razdel programmy MGG* (*Glyatsiologiya*) [*Glaciological studies. Collected papers. Division 9 of the I.G.Y. programme* (*glaciology*)], No. 5, 1960, p. 27–37. [Growth and orientation of crystals. English summary.]

KRISTRUP, BØRGE. Studies of four glaciers in Greenland. *Geografisk Tidsskrift*, Bd. 59, 1960, p. 89–102, illus., map. [Morphology of Napassorssuaq Gletscher, south Greenland, Sermikavsak, west Greenland, Hurlbut Gletscher, north-west Greenland, and Mitdluagkat Gletscher, east Greenland, in relation to physiography, climate and change of climate.]

SHARP, ROBERT P. *Glaciers*. Oregon, University of Oregon Press, 1960. vii, 78 p., illus., diagrs., tables. 25 cm. $1.25. [Description of some basic glaciological facts.]

KOBLENTS, YA. P. "Ischeznuvshiye" ledniki [Glaciers which have "disappeared"]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 20, 1960, p. 43–46, maps. [Glaciers plotted on coast of Australian Antarctic Territory by Americans in 1946–48 found not to exist by Soviet explorers in 1955–59.]

SHUMSKIY, P. A. Osnovnyye rezul'taty issledovaniya antarkticheskogo lednikovogo pokrova [Main results of study of the Antarctic ice sheet]. *In*: TRESHNIKOV, A. F., *ed. Vtoraya kontinental'naya ekspeditsiya 1956–1958 gg. Nauchnyye rezul'taty* [*Second continental expedition, 1956–58. Scientific results*] (Leningrad, 1960), [numbered "9"], p. 126–70. [Morphology, thickness, temperature regime, structure, movement. Based on traverses in 1957.]

BUYNITSKIY, V. KH. Shel'fovyy lednik Lazarev, yego morfologiya i proiskhozhdeniye [Lazarev Ice Shelf, its morphology and origin]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 18, 1960, p. 5–8. [Brief description of ice shelf on which stands Soviet station Lazarev, in Dronning Maud Land.]

WEBER, J. R. *Comparison of gravitational and seismic depth determinations on the Gilman Glacier and adjoining ice cap in northern Ellesmere Island.* Ottawa, Department of National Defence, 1960. 12 p., maps, diagrs. (Hazen II.) [1957–58.]

FROLOV, A. I., *and* KORYAKIN, YE. D. Issledovaniye podlednogo rel'yefa v rayone stantsii Lazarev gravimetricheskim metodom [Study of sub-ice relief in the region of "Lazarev" station by gravimetry]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 23, 1960, p. 33–36, map. [Dronning Maud Land.]

HOINKES, H. Neue Ergebnisse der glaziologischen Erforschung der Antarktis. 1: Die Mächtigkeit des antarktischen Landeises—die Topographie des Untergrundes. *Die Umschau*, 1960, Hft. 18, p. 549–53, illus. [Depth measurements on Antarctic ice cap during period 1957–59.]

HOINKES, H. Neue Ergebnisse der glaziologischen Erforschung der Antarktis. 2. Die grossen Eis-Schelfe—das Bild des antarktischen Kontinents. *Die Umschau*, 1960, Hft. 19, p. 596–98, illus. [Survey of Antarctic ice shelf traverses 1957–59 and contributions to solution of question "Is Antarctica a continent?".]

KAPITSA, A. P. Novyye dannyye o moshchnosti lednikovogo pokrova tsentral'nykh rayonov Antarktidy [New data on the thickness of the ice cover of the central regions of Antarctica]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 19, 1960, p. 10–14. [*Seismic* profile from Komsomol'skaya to South Pole.]

MAKSIMOV, I. V. Izmeneniye urovnya mirovogo okeana v svyazi s izmeneniyem moshchnosti materikovykh l'dov Antarktidy [Change of level of world ocean in connexion with change of thickness of continental ice of Antarctica]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 19, 1960, p. 5–7. [Rise in sea level equated to melting of Antarctic ice sheet.]

MELLOR, MALCOLM. Temperature gradients in the Antarctic ice sheet. *Journal of Glaciology*, Vol. 3, No. 28, 1960, p. 773–82, illus. [Measurements of ice temperature to depths of 30–40 m. on ice sheet in Mac-Robertson Land.]

RAZUMEYKO, N. G. Statsionarnyye issledovaniya na kupole Churlyanisa [Studies at Churlyanis ice cap station]. *Materialy Glyatsiologicheskikh Issledovaniy. Zemlya Frantsa Iosifa* [*Glaciological Observations. Zemlya Frantsa Iosifa*] (Moscow), 1960, 176 p. (Temperatura snega i l'da [Snow and ice temperature], Vypusk 1.) [Observations in full, 1957–59.]

MARKIN, V. A. Aktinometricheskiye nablyudeniya [Actinometrical observations]. *Materialy Glyatsiologicheskikh Issledovaniy. Zemlya Frantsa Iosifa* [*Glaciological Observations. Zemlya Frantsa Iosifa*] (Moscow), 1960, 135+149 p. (Meteorologiya [Meteorology], Vypusk 3, 4.) [Observations in full on Churlyanis ice cap, 1957–58 and 1958–59.]

LOEWE, FRITZ. Notes concerning the mass budget of the Antarctic inland ice. In: *Antarctic Meteorology, Proceedings of the Symposium held in Melbourne...* London, Pergamon Press, [c1960], p. 361–69, table. [Present budget shows a gain of substance.]

KOTLYAKOV, V. M. Izmereniye prikhoda lednikovogo pokrova Antarktidy [Measurement of mass accumulation of the Antarctic ice sheet]. *Glyatsiologicheskiye issledovaniya.*

Sbornik statey. IX razdel programmy MGG (Glyatsiologiya) [*Glaciological studies. Collected papers. Division 9 of the I.G.Y. programme (glaciology)*] No. 5, 1960, p. 7–26. [General summary, based on observations by many expeditions since 1949, English summary.]

Svatkov, N. M. Dvizheniye l'da v lednike Shokal'skogo [Movement of ice in Lednik Shokal'skogo]. *Glyatsiologicheskiye issledovaniya. Sbornik statey. IX razdel programmy MGG (Glyatsiologiya)* [*Glaciological studies. Collected papers. Division 9 of the I.G.Y. programme (Glaciology)*], No. 5, 1960, p. 56–71, maps.

Bardin, V. I., *and* Shil'nikov, V. I. "Produktivnost'" berega Vostochnoy Antarktidy ["Productivity" of the coast of eastern Antarctica]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 23, 1960, p. 28–32. [Amount of ice lost to Antarctica annually through calving of icebergs.]

Yevteyev, S. A. Priblizhennyy raschet skorosti dvizheniya lednikovykh potokov po shirine produtsiruyemykh aysbergov [Approximate calculation of the speed of movement of ice streams based on the width of the icebergs they calve.]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 19, 1960, p. 15–17. [Based on contention that one iceberg is calved each year.]

Sagar, R. Brian. *Glacial–meteorological observations in northern Ellesmere Island during phase 3, "Operation Hazen" May–August 1958.* Ottawa, Department of National Defence, 1960. x, 186 p., maps, tables, diagrs. 28 cm. (Hazen 13.)

Bardin, V. I. Novyy vzglyad na prirodu lednikovogo yazyka Ninnisa [New view of the nature of the Ninnis Glacier Tongue]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 20, 1960, p. 38–42, map. [Suggestion that it is the remains of an ice shelf.]

Post, Austin S. The exceptional advances of the Muldrow, Black Rapids, and Susitna glaciers. *Journal of Geophysical Research*, Vol. 65, No. 11, 1960, p. 3703–12, maps, diagrs. [Suggests due to unstable dynamic conditions in glaciers rather than external causes.]

Panzarini, Rodolfo N. *Nomenclatura del hielo en el mar.* Buenos Aires, Instituto Antártico Argentino, 1960. 58 leaves, diagrs. 29½ cm. [Floating ice nomenclature based on World Meteorological Organization's report of 1956, with additions, and English, French, German, Russian and Spanish equivalents. Also symbols used to represent types of ice.]

Preobrazhenskiy, Yu. B., *ed. Al'bom aerofotosnimkov ledovykh obrazovaniy na moryakh* [*Album of air photographs of ice formations at sea*]. Leningrad, Gidrometeorologicheskoye Izdatel'stvo [Hydrological and Meteorological Publishing House], 1960. 223 p., illus. 30 cm.

Avgevich, V. I. Aerofotos"yemka i stereofotogrammetriya [Air survey and stereophotogrammetry]. *Sovetskaya Geografiya. Itogi i Zadachi* [*Soviet Geography. Results and Tasks*] (Moscow), 1960, p. 487–508. [Includes summary of recent advances in technique of study of sea ice and land ice from air photography.]

Antipova, Ye. G. K metodike prognozov poyavleniya l'da na rekakh basseyna Severnoy Dviny [Methods of forecasting appearance of ice on rivers of the Severnaya Dvina basin]. *Meteorologiya i Gidrologiya* [*Meteorology and Hydrology*], 1960, No. 11, p. 31–32. [Based on correlation with atmospheric processes in early October.]

Kirillov, A. A. Dolgosrochnyye ledovyye prognozy i ikh opravdayemost' dlya arkticheskikh morey [Long range ice forecasts and their verification for Arctic seas]. *Problemy Arktiki i Antarktiki* [*Problems of the Arctic and Antarctic*], Vypusk 4, 1960, p. 26–37. [Percentage correctness of Soviet forecasts for Northern Sea Route, 1954–58. Expected effect of new icebreakers *Lenin* and *Moskva* on navigation.]

[Arctic Ocean : Sea ice Distribution] *Report of the ice observing and forecasting program, 1958.* Washington, D.C., U.S. Navy Hydrographic Office, 1959. ix, 148 p., maps. 26½ cm. $1.50 (TR-66.) [North American Arctic.]

Goedecke, Erich. Die Eisverhältnisse im Skagerrak und Kattegat. *Handbuch für Skagerrak und Kattegat* (Hamburg), 1 Teil (Nr. 2005A), 1960, p. 111–19, tables. [Includes ice-frequency data for Danish coast (1930–57) and Swedish coast (1930–59).]

[North Atlantic : Sea Ice] Notes on ice conditions in areas adjacent to the north Atlantic ocean from April to June, 1960. *Marine Observer*, Vol. 30, No. 190, 1960, p. 214–17, map, tables.

[North Atlantic : Distribution of Floating Ice] Notes on ice conditions in areas adjacent to the North Atlantic Ocean from July to September 1960. *Marine Observer*, Vol. 31, No. 191, 1961, p. 41–43, map.

Goedecke, Erich. Die Eisverhältnisse in der südlichen Ostsee. *Ostsee-Handbuch*, IV Teil. D.H.I. Nr. 2003, 1959, p. 214–23. [Sea ice conditions in southern Baltic 1920/21–1944/45.]

AMPBELL, N. J., *and* LAUZIER, L. M. Ice studies of the Atlantic oceanographic group. *Fisheries Research Board of Canada, Manuscript Report Series (Oceanographic and Limnological)* No. 60, 1960, 12 leaves. [Ice studies since 1954 in Canadian Arctic waters and Gulf of Saint Lawrence.]

WITHINBANK, CHARLES WINTHROP MOLESWORTH. *Ice Atlas of Arctic Canada....* Ottawa, Defence Research Board, 1960. [ii] 67 p., charts. 86 × 51 cm. $7.50. [Charts summarizing ice conditions March–November at stations Icy Cape, Alaska to Davis Strait and Canadian Arctic islands. Compiled from ships' logs and other sources 1900–58.]

LDOSHINA, YE. I. Izmeneniye ledovitosti i polozheniya kromki l'da v Yaponskom i Okhotskom moryakh v vesenne-letneye vremya [Change in ice concentration and position of ice edge in the Japan and Okhotsk Seas in spring and summer]. *Trudy Gosudarstvennogo Okeanograficheskogo Instituta* [*Transactions of the State Oceanographical Institute*], Vypusk 54, 1960, p. 22–34. [Variability, 1929–58.]

REED, RICHARD J., *and* CAMPBELL, WILLIAM J. *Theory and observations of the drift of ice station Alpha.* Seattle, University of Washington, Department of Meteorology and Climatology, 1960. xv, 255 p., maps, diagrs., tables. 28 cm. (Final Report NR 307–250.)

OLUNIN, NICHOLAS. Macroscopic plant materials. *In*: BUSHNELL, VIVIAN, *ed. Scientific Studies at Fletcher's Ice Island, T-3, 1952–1955*, Vol. 3, 1960, p. 73–85, illus., maps. [Plant fragments on T-3 suggest ice island originated in high latitudes; possible sources discussed.]

TOIBER, RICHARD E., *and others.* Petrographic evidence on the source area and age of T-3. By Richard E. Stoiber, John B. Lyons, William T. Elberty and Richard H. McCrehan. *In*: BUSHNELL, VIVIAN, *ed. Scientific Studies at Fletcher's Ice Island, T-3, 1952–1955*, Vol. 3, 1960, p. 58–72, illus., tables, diagrs.

BARGHOORN, ELSO S. Palynological studies of organic sediments and of coated slides. *In*: BUSHNELL, VIVIAN, *ed. Scientific studies at Fletcher's Ice Island, T-3, 1952–1955*, Vol. 3, 1960, p. 86–91, tables. [Evidence suggests T-3 is relatively recent accumulation not representing a substantial segment of post glacial geologic time.]

CROMIE, WILLIAM J. *Preliminary results of investigations on Arctic drift station Charlie.* Palisades, N.Y., Columbia University, Lamont Geological Observatory, 1960. [33] p., illus., map, diagrs. 28 cm. (Scientific Report, No. 3.) [Work done on drifting station, July–August, 1959, over Chukchi shelf.

BLACK, W. A. Gulf of St Lawrence ice survey, winter 1960. *Canada, Department of Mines and Technical Surveys, Geographical Branch, Geographical Paper* No. 25, 1960. 64 p., illus., maps, tables. [Includes survey of St Lawrence between Montreal and Quebec.]

KEITH, E. L. Ice conditions in the Churchill area for the winter of 1959–1960. *Canada, Department of National Defence, Defence Research Northern Laboratory DRNL Technical Note* No. 6/60, 1960, 8 leaves, diagrs., tables. [Observations of ice growth on large bodies of fresh and salt water, Farnsworth Lake, Churchill River, Hudson's Bay.]

SCHWERDTFEGER, P. Observations on estuary ice. *Canadian Journal of Physics*, Vol. 38, No. 10, 1960, p. 1391–94, illus., diagrs. [Thermal régime study of Churchill River, near Hudson Bay, Canada, 1960.]

PANOV, BORIS PAVLOVICH. *Zimniy rezhim rek SSSR* [*Winter regime of rivers of the U.S.S.R.*]. Leningrad, Izdatel'stvo Leningradskogo Universiteta [Publishing House of Leningrad University], 1960. 240 p. 23 cm. [Includes particulars of ice régime of many rivers.]

CARLSON, CHARLES E., *and* HUSSEY, KEITH M. Hydrodynamics in three Arctic lakes. *Journal of Geology*, Vol. 68, No. 6, 1960, p. 585–600, illus., tables. [Currents generated by prevailing winds with and without presence of floating ice.]

VTYURIN, B. I. Ozernyy led v rayone kholmov Banger-Khils v Antarktide [Lake ice in the Bunger Hills region, Antarctica]. *Issledovaniya Ionosfery. Sbornik statey. V razdel programmy MGG* (*Ionosfera*) [*Study of the ionosphere. Collected papers. Section 5 of the I.G.Y. programme* (*ionosphere*)], No. 5, 1960, p. 131–35. [Types found in 'oasis' region.]

FROZEN GROUND. PERMAFROST

YEFIMOV, A. I., *ed.* Sbornik statey po obshchemu merzlotovedeniyu [Collected papers on general permafrost studies]. *Trudy Instituta Merzlotovedeniya im. V. A. Obrucheva Transactions of the V. A. Obruchev Institute of Permafrost Studies*], Tom 16, 1960, 191 p. [Recent studies of character and behaviour of frozen ground in U.S.S.R.]

KOREYSHA, M. M. O sootnoshenii sovremennogo oledeneniya i tarynov (naledey) khrebta Suntar-Khayata [Relation of present ice cover and "icings" in Khrebet Suntar-Khayata]. *Issledovaniya Ionosfery. Sbornik statey. V razdel programmy MGG* (*Ionosfera*) [*Study of the ionosphere. Collected papers. Section 5 of the I.G.Y. programme* (*ionosphere*)], No. 5, 1960, p. 124–30, map. [Interrelation of glaciers and "icings" in Yakutskaya A.S.S.R. English summary.]

HATHERTON, T. Electrical resistivity of frozen earth. *Journal of Geophysical Research*, Vol. 65, No. 9, 1960, p. 3023–24, diagr. [Scott Base and Hallett Station, Antarctica, 1957–58.]

IVES, JACK D. Permafrost in central Labrador-Ungava. *Journal of Glaciology*, Vol. 3, No. 28, 1960, p. 789–90, map. [Investigations near Schefferville and Wabush Lake show permafrost to extend farther south of 55th parallel than previously thought.]

GLACIAL GEOLOGY

ROBITAILLE, BENOIT. Aperçu géomorphologique de la rive Québécoise du Détroit d'Hudson. *Revue Canadienne de Géographie*, Vol. 13, Nos. 3–4, 1959, p. 147–54, illus. [Study of geomorphology of Hudson Strait, between Cape Wolstenholme and Wakeham Bay. English abstract.]

MACKAY, J. ROSS. Crevasse fillings and ablation slide moraines, Stopover Lake area, N.W.T. *Geographical Bulletin*, No. 14, 1960, p. 89–99, illus., maps. [Northwest Territories, Canada. Features of "dead-ice" landscape described.]

RÓŻYCKI, S. Z. O vremeni obrazovaniya oazisa Banger-Khils [Dating the "oasis" of Bunger Hills]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 20, 1960, p. 10–14, illus. [Attempt to date disappearance of ice cover.]

VORONOV, P. S. Opyt restavratsii lednikovogo shchita Antarktidy epokhi maksimal'nogo oledeneniya Zemli [Attempt to reconstruct the ice sheet of Antarctica at the time of maximum glaciation on Earth]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 23, 1960, p. 15–19, map.

FEYLING-HANSSEN, ROLF W., *and* OLSSON, INGRID. Five radiocarbon datings of Post Glacial shorelines in central Spitsbergen. *Norsk Geografisk Tidsskrift*, Bd. 17, Hft. 1–4, 1959–60, p. 122–31, illus. [Results of radiocarbon datings of five shell samples from Late Pleistocene, illustrating main trend in negative shift of shoreline during Post Glacial time.]

OCEANOGRAPHY. HYDROGRAPHY. HYDROLOGY

TIMOFEYEV, VLADIMIR TIMOFEYEVICH. *Vodnyye massy arkticheskogo basseyna* [*Water masses of the Arctic basin*]. Leningrad, Gidrometeorologicheskoye Izdatel'stvo [Hydrological and Meteorological Publishing House], 1960. 191 p., maps. 23 cm. [Character and dynamics, based largely on work of Soviet drifting stations.]

TRESHNIKOV, A. F. Arktika raskryvayet svoi tayny [The Arctic reveals its secrets]. *Priroda* [*Nature*], 1960, No. 2, p. 25–32, maps. [Bottom relief and water masses of Arctic basin.]

LUMBY, JOHN R., *comp.* Atlas of track charts of IGY cruises, part 1: North Atlantic. *IGY Oceanography Report*, No. 1, 1960, iii, 46 p., maps.

KOROLEFF, FOLKE. Temperature and salinity at the fixed Finnish stations July 1954–Dec. 1956. *Merentutkimuslaitoksen Julkaisu*, No. 192, 1959, 147 p., map. [Baltic.]

GRAINGER, E. H. Some physical oceanographic features of southeast Hudson Bay and James Bay. *Fisheries Research Board of Canada, Manuscript Report Series* (*Oceanographic and Limnological*), No. 71, 1960, [41] p., maps, tables, diagrs.

DODIMEAD, A. J., *and others*. Oceanographic data record, north Pacific survey. January 12 to February 10, 1960. By A. J. Dodimead, K. B. Abbott-Smith and H. J. Hollister. *Canada, Fisheries Research Board, Manuscript Report Series* (*Oceanographic and Limnological*), No. 63, 1960, 136 p., illus., map, tables, diagrs.

KLEPIKOV, V. V. O pridonnykh vodakh v more Uedella [Bottom water in the Weddell Sea]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 18, 1960, p. 20–23. [Origin, based on recent Argentine and American work from Filchner Ice Shelf.]

HUNKINS, KENNETH. *Seismic studies of the Arctic Ocean floor*. Palisades, N.Y., Columbia University, Lamont Geological Observatory, 1960. [33] p., illus., maps, diagrs. 28 cm. (Scientific Report No. 1). [Bottom topography measurements made from Drifting Station Alpha, July 1957–November 1958 between lat. 83°–86° N. and long. 115°–175° W.]

KOBLENTS, YA. P. Novyye dannyye o shel'fe Vostochnoy Antarktiki [New data on the shelf of eastern Antarctica]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 23, 1960, p. 39–41. [Profiles of submarine relief at seven places.]

Mal'tsev, V. N. Opyt podkhoda d/e "Ob'" k avstraliyskoy stantsii Moyson [Approach of the Ob' to the Australian station Mawson]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 18, 1960, p. 30–31, map. [Submarine relief of sea approaches.]

Zhivago, A. V. Geomorfologicheskiye issledovaniya [Geomorphological studies]. *In*: Maksimov, I. V., *ed. Vtoraya morskaya ekspeditsiya na d/e "Ob'", 1956–1957 gg. Nauchnyye rezul'taty* [*Second marine expedition in the Diesel-electric ship Ob', 1956–57. Scientific results*] (Leningrad, 1960), [numbered "7"], p. 44–72, maps. [Submarine relief of South Indian Ocean.]

Manzer, J. I., *and* Hollister, H. J. Data record of bathythermograms observed by Fisheries Research Board chartered fishing vessels March–September 1959. *Fisheries Research Board of Canada. Manuscript Report Series* (*Oceanographic and Limnological*), No. 66, 1960, [44] p., illus., maps, tables, diagrs. [Measurements of seawater temperatures in northeast Pacific made by M.V. *Key West II* and M.V. *Fort Ross* engaged on marine salmon and Fur Seal investigation surveys.]

Bogdanov, M. A. Izmereniya poverkhnostnoy temperatury vody elektrotermometrom v yuzhnoy chasti Tikhogo okeana [Measurements of the surface temperature of the water by electrothermometer in the southern part of the Pacific Ocean]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 20, 1960, p. 33–37, map. [Observations from *Ob'* in 1958.]

Barkley, Richard A., *and* Thompson, Thomas G. The total iodine and iodate–iodine content of sea water. *Deep-Sea Research*, Vol. 7, 1960, p. 24–34, map, tables. [Northeast Pacific and Arctic Ocean.]

Wyrtki, Klaus. The Antarctic circumpolar current and the Antarctic polar front. *Deutsche Hydrographische Zeitschrift*, Jahrg. 13, Hft. 4, 1960, p. 153–74, diagrs. [Theoretical consideration of Sverdrup-type solution of circumpolar current.]

Antonov, V. S., *and others*. Problema issledovaniy ust'yev severnykh sibirskikh rek [The problem of studies of the mouths of north Siberian rivers. By V. S. Antonov, A. P. Burdykina, M. K. Fedorov]. *Problemy Arktiki i Antarktiki* [*Problems of the Arctic and Antarctic*], Vypusk 4, 1960, p. 38–51. [Summary of recent activities in studying influence of river water on sea and sea ice, rate of river flow, and shipping channels.]

METEOROLOGY. CLIMATOLOGY

Krichak, O. G., *ed. Nauchnaya konferentsiya po problemam meteorologii Antarktiki* [*Scientific conference on problems of the meteorology of the Antarctic*]. Moscow, 1959. 48 p. [Abstracts of papers read.]

Mirabito, John A. *Notes on Antarctic weather analysis and forecasting*. Norfolk, Va., U.S. Navy Weather Research Facility, 1960. v, 71 p., maps. 26½ cm. (NWRF 16-1260-038.) [General description of Antarctic weather phenomena. Bibliography.]

[Greenland : Meteorological Observations] Flagget fires i Myggbukta. *Polarboken*, 1959–60, p. 69–71, illus. [History of Norwegian meteorological station Myggbukta, east Greenland.]

Schwerdtfeger, Werner, *and others*. Meteorología descriptive del sector Antártico sudamericano. By W. Schwerdtfeger, Luis María de la Canal y Jorge Scholten. *Instituto Antártico Argentino Publicación* No. 7, 1959, 425 p., illus., map. [Detailed account of meteorology of South American sector of Antarctic using climatological and synoptic observations up to 1957.]

[Terre Adélie : Weather Reports] Climatologie, Terre Adélie. *T.A.A.F. Terres Australes et Antarctiques Françaises*, No. 11, 1960, p. 44, table. [January–March 1960.]

[Iles Kerguelen : Weather Reports] Climatologie, Kerguelen. *T.A.A.F. Terres Australes et Antarctiques Françaises*, No. 11, 1960, p. 45, table. [January–March 1960.]

[Ile Amsterdam : Weather Reports] Climatologie, Nouvelle Amsterdam. *T.A.A.F. Terres Australes et Antarctiques Françaises*, No. 11, 1960, p. 46, table. [January–March 1960.]

[Greenland : Meteorological Observations] *Summaries of weather observations at weather stations in Greenland 1954–1958*. Charlottenlund, Det Danske Meteorologiske Institut, 1961. 248 p. 30 cm.

Panzarini, Rodolfo N. *Report to S.C.A.R. on Antarctic scientific activities during the International Geophysical Year 1957–58*. Buenos Aires. Instituto Antártico Argentino, 1960. 32 leaves. 29½ cm.

Gaygerov, S. S. Nekotoryye dannyye aerologicheskogo issledovaniya atmosfery Antarktidy [Some data on study of the upper atmosphere of Antarctica]. *Trudy Tsentral'noy Aerologicheskoy Observatorii* [*Transactions of the Central Aerological Observatory*]. Vypusk 27, 1959, 87 p. [Analysis of upper air observations at Mirnyy, 1957.]

Shlyakhov, V. I. Metodika metelemernykh nablyudeniy v Antarktike [Technique of observing drifting snow in the Antarctic]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 20, 1960, p. 26–28, illus. [Description of gauge.]

Smirnov, V. B. Predvaritel'nyye rezul'taty ispytaniy samoletnoy ionosfernoy stantsii v Arktiki [Preliminary results of testing an airborne ionospheric station in the Arctic]. *Issledovaniya ionosfery. Sbornik statey. V razdel programmy MGG* (*Ionosfera*) [*Study of ionosphere. Collected papers. Section 5 of the I.G.Y. programme* (*ionosphere*)], No. 5, 1960, p. 106–13. [Equipment and results obtained on flight in Ostrov Diksona area, September 1958.]

Dickey, Woodrow W. Forecasting maximum and minimum temperatures. *U.S. Department of Commerce, Forecasting Guide* No. 4, 1960, 59 p., maps, diagrs., tables.

Girs, A. A. Izucheniye atmosfernoy tsirkulyatsii Arktiki i resheniye problemy dolgosrochnykh meteorologicheskikh prognozov [Study of the atmospheric circulation of the Arctic and solution of the problem of long range meteorological forecasts]. *Problemy Arktiki i Antarktiki* [*Problems of the Arctic and Antarctic*], Vypusk 4, 1960, p. 52–63. [How study of Arctic circulation has helped to improve forecasting techniques.]

Godson, Warren L., *and* Macfarlane, M. Aylmer. Tropospheric geopotential and velocity variances over the Arctic. *Tellus*, Vol. 12, Nr. 3, 1960, p. 259–65, illus. [Theoretical treatment of the relation between contour height and geostrophic wind variances.]

Krichak, O. G. Osobennosti atmosfernoy tsirkulyatsii nad Antarktikoy i yuzhnym polushariyem [Features of the atmospheric circulation over the Antarctic and the southern hemisphere]. *In*: Treshnikov, A. F., *ed. Vtoraya kontinental'naya ekspeditsiya 1956–1958 gg. Nauchnyye rezul'taty* [*Second continental expedition, 1956–58. Scientific results*] (Leningrad, 1960) [numbered "9"], p. 50–62.

Hanessian, John, *jr., and* Guttmacher, Ilene, *eds.* Experimental results of the U.S. rocket program for the International Geophysical Year to 1 July 1958. *IGY Rocket Report Series* (Washington, D.C.), no. 1, 1958, v, 236 p., illus., diagrs., tables. [Atmospheric structure, ion composition of Arctic ionosphere, auroral particles and soft radiation, solar radiation, cosmic rays, earth's magnetic field.]

Gaygerov, S. S. O stroyenii atmosfery Antarktiki [Structure of the atmosphere of the Antarctic.] *In*: Treshnikov, A. F., *ed. Vtoraya kontinental'naya ekspeditsiya 1956–1958 gg. Nauchnyye rezul'taty* [*Second continental expedition, 1956–58. Scientific results*] (Leningrad, 1960) [numbered "9"], p. 68–110.

Hare, F. Kenneth. The summer circulation of the arctic stratosphere below 30 km. *Quarterly Journal of the Royal Meteorological Society*, Vol. 86, No. 368, 1960, p. 127–43, maps, diagrs., tables.

Hanson, K. J. A case study of the explosive stratospheric warming over the Antarctic, October 1958. In: *Antarctic Meteorology, Proceedings of Symposium held in Melbourne.* . . . London, Pergamon Press, [°1960], p. 128–37, diagrs. [Data collected over two years at Amundsen–Scott IGY (South Pole) station.]

Taylor, Ronald C. The topography of the 400°K isentropic surface over Antarctica: spring 1957. *IGY General Report* No. 11, 1960, [70] p., maps. (IGY World Data Center A, Washington, D.C.) [Data supplementing paper: Vernal breakdown of the stratospheric cyclone over the south pole, by C. E. Palmer and R. C. Taylor, *Journal of Geophysical Research*, Vol. 65, No. 10, 1960, p. 3319–29, reprinted here.]

MacDowall, J. Distribution of atmospheric ozone; a preliminary analysis of some International Geophysical Year observations. *Nature*, Vol. 187, No. 4735, 1960, p. 382–83, diagrs. [Observations from Halley Bay, Antarctica.]

Chapman, John H. The polar radio black-out of the ionosphere of 7 July, 1958. *Canadian Journal of Physics*, Vol. 38, No. 9, 1960, p. 1195–1212, illus., maps, diagrs., tables. [Illustrates the separate development of polar cap, and auroral absorption in both polar regions.]

Kundu, M. R., *and* Haddock, F. T. A relation between solar radio emission and polar cap absorption of cosmic noise. *Nature*, Vol. 186, No. 4725, p. 610–13, tables, diagrs.

Besprozvannaya, A. S., *and* Driatskiy, V. M. Anomal'noye pogloshcheniye v polyarnoy oblasti po nablyudeniyam metodom vertikal'nogo zondirovaniya ionosfery [Anomalous absorption in polar regions, based on observations obtained by vertical sounding of the ionosphere]. *Issledovaniya Ionosfery. Sbornik statey. V razdel programmy MGG* (*Ionosfera*) [*Study of the ionosphere. Collected papers. Section 5 of the I.G.Y. programme* (*ionosphere*)], No. 5, 1960, p. 7–19. [Arctic.]

Besprozvannaya, A. S. K voprosu otsenki vozmushchennosti sloya F2 v vysokikh shirotakh [Estimating the disturbance of the F2 layer in high latitudes]. *Issledovaniya Ionosfery. Sbornik statey. V razdel programmy MGG* (*Ionosfera*) [*Study of the ionosphere. Collected papers. Section 5 of the I.G.Y. Programme* (*ionosphere*)], No. 5, 1960, p. 81–92. [Arctic.]

GERSON, N. C. The Arctic ionosphere and solar activity. *Annales de Géophysique*, Tome 16, No. 2, 1960, p. 253–61, tables, diagrs. [Ionospheric conditions at various Arctic stations correlated with solar activity.]

GODSON, WARREN L. Total ozone and the middle stratosphere over arctic and sub-arctic areas in winter and spring. *Quarterly Journal of the Royal Meteorological Society*, Vol. 86, No. 369, 1960, p. 301–17, diagrs. [Northern Europe and Canada.]

GHERZI, E. Atmospherics on 20 kc./s. at the time of local aurorae. *Nature*, Vol. 187, No. 4733, 1960, p. 225–26.

LEINBACH, HAROLD. Catalog of I.G.Y. riometer data for Alaska and Thule, Greenland. *I.G.Y. Aurora* (*Instrumental*) *Report* (College, Alaska), No. 1 [1959?], [117] p., tables, diagrs. [Riometer records of 27·6 mc/s. cosmic noise.]

FEDYAKINA, N. I. Anomal'noye pogloshcheniye v maye i iyule 1959 g. po nablyudeniyam v bukhte Tiksi metodom kosmicheskogo radioizlucheniya [Abnormal absorption in May and July 1959, based on observations at Bukhta Tiksi by the cosmic radio emission method]. *Issledovaniya Ionosfery. Sbornik statey. V razdel programmy MGG* (*Ionosfera*) [*Study of the ionosphere. Collected papers. Section 5 of the I.G.Y. programme* (*ionosphere*)], No. 5, 1960, p. 20–27.

GUSTAFSSON, GEORG, *and others*. Audio-frequency electromagnetic radiation in the auroral zone. By Georg Gustafsson, Alv Egeland and Jules Aarons. *Journal of Geophysical Research*, Vol. 65, No. 9, 1960, p. 2749–58, diagrs. [Records from Kiruna, Sweden.]

ALLCOCK, G. McK. Propagation of whistlers to polar latitudes. *Nature*, Vol. 188, No. 4752, 1960, p. 732–33. [Examination of coincident whistlers from Scott Base, Antarctica, and Wellington and Dunedin, New Zealand.]

ASTAPENKO, P. D. *Atmosfernyye protsessy v vysokikh shirotakh yuzhnogo polushariya* [*Atmospheric processes in high southern latitudes*]. Moscow, Izdatel'stvo Akademii Nauk SSSR [Publishing House of the Academy of Sciences of the U.S.S.R.], 1960. 282 p., maps, 26 cm. (II razdel programmy MGG (Meteorologiya) [Section 2 of the I.G.Y. programme (Meteorology)], No. 3.)

BERSON, F. A., *and* RADOK, U. Antarctic surges and the zonal circulation. In: *Antarctic Meteorology, Proceedings of Symposium held in Melbourne*....London, Pergamon Press, [°1960], p. 193–216, maps, tables.

HANNAY, A. K. Cold outbreaks in southern Australia in relation to sub-Antarctic circulations. In: *Antarctic Meteorology, Proceedings of Symposium held in Melbourne*.... London, Pergamon Press, [°1960], p. 153–75, maps, tables. [Value of Antarctic data to Australian synoptic meteorology discussed.]

KRAUS, E. B. Problems of long term interaction between the Antarctic and temperate latitudes. In: *Antarctic Meteorology, Proceedings of Symposium held in Melbourne*.... London, Pergamon Press, [°1960], p. 145–52, diagrs.

TRELOAR, H. M. Cold-streams from Antarctica and Southern Ocean latitudes reaching Melbourne and some effects on Australian weather. In: *Antarctic Meteorology, Proceedings of Symposium held in Melbourne*.... London, Pergamon Press, [°1960], p. 176–92, map, tables.

SHAPAYEV, V. M. Sluchay regeneratsii tsiklona na antarkticheskom fronte [A case of cyclone regeneration on the Antarctic front]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 19, 1960, p. 31–34. [Example from Queen Mary Land and Wilkes Land region in January 1958.]

TOLSTIKOV, YE. I. Vozdushnyye massy nad tsentral'nymi rayonami vostochnoy Antarktidy [Air masses over the central regions of eastern Antarctica]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 19, 1960, p. 21–25. [Analysis of movements of air masses in 1958.]

CHERNIGOVSKIY, N. T. Aktinometricheskiye issledovaniya v sovetskoy Arktike [Actinometrical studies in the Soviet Arctic]. *Problemy Arktiki i Antarktiki* [*Problems of the Arctic and Antarctic*], Vypusk 4, 1960, p. 91–96. [Survey of Soviet contribution.]

SHLYAKHOV, V. I. Nekotoryye rezul'taty aktinometricheskikh issledovaniy [Some results of actinometrical observations]. *In*: TRESHNIKOV, A. F., *ed. Vtoraya kontinental'naya ekspeditsiya 1956–1958 gg. Nauchnyye rezul'taty* [*Second continental expedition, 1956–58. Scientific results*] (Leningrad, 1960) [numbered "9"], p. 63–67. [At Mirnyy.]

FENN, ROBERT W., *and* WEICKMANN, HELMUT K. Atmospheric net radiation flux during winter in the Thule area, Greenland. *Journal of Geophysical Research*, Vol 65, No. 11, 1960, p. 3651–56, diagrs. [Airborne infra-red net radiation receiver described and results of radiosonde flights with this element at Thule, Greenland, February 1959.]

RAYNER, J. N., *ed. Temperature and wind frequency tables for North America and Greenland.* Montreal, McGill University Arctic Meteorology Research Group, 1960. 2 vols., tables. 28 cm. (Arctic Meteorology Research Group Publication in Meteorology Nos. 24 and 25). [January to December.]

Rayner, J. N., *ed. Temperature and wind frequency tables for Eurasia. Vol. 3. July–September.* Montreal, McGill University, Arctic Meteorology Research Group, 1960. ii, 206 p., tables. 28 cm. (Arctic Meteorology Research Group Publication in Meteorology No. 21.)

Rayner, J. N., *ed. Temperature and wind frequency tables for Eurasia. Vol. 4. October–December.* Montreal, McGill University, Arctic Meteorology Research Group, 1960. ii, 206 p., tables. 28 cm. (Arctic Meteorology Research Group Publication in Meteorology, No. 23.)

Kopanev, I. D. O turbulentnom teploobmene v Antaktide [Turbulent heat exchange in Antarctica]. *Izvestiya Akademii Nauk SSSR. Seriya Geograficheskaya* [*News of the Academy of Sciences of the U.S.S.R. Geographical Series*], 1960, No. 6, p. 85–90. [Experiments carried out at Mirnyy in 1957.]

Wexler, Harry. Seasonal and other temperature changes in the Antarctic atmosphere. *Quarterly Journal of the Royal Meteorological Society*, Vol. 86, No. 368, 1960, p. 283–87. [Discussion of paper read by Harry Wexler, printed in *Quarterly Journal of the Royal Meteorological Society*, Vol. 85, No. 365, 1959, p. 196–208.]

Loon, H. van. A rapid fall of pressure at the Kerguelen Islands. *News Letter* (Pretoria), No. 137, 1960, p. 10–11, map, diagrs. [9th August 1960.]

Dolgin, I. M., *and* Sokolov, S. I. Sravnitel'naya kharakteristika vetrovogo rezhima v Mirnom i na dreyfuyushchey stantsii "Severnyy polyus-7" [Comparison of the wind at Mirnyy and at drifting station North Pole 7]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 19, 1960, p. 26–30. [Comparative strengths and directions in Arctic and Antarctic, 1956–58.]

Voskresenskiy, A. I., *and* Matveyev, L. T. Vodnost' i turbulentnyy rezhim sloisto-obraznykh oblakov Arktiki [Water content and turbulence of layer clouds in the Arctic]. *Meteorologiya i Gidrologiya* [*Meteorology and Hydrology*], 1960, No. 11, p. 14–19. [Observations from aircraft over Arctic basin.]

Alvarez, J. A., *and* Lieske, B. J. The Little America blizzard of May 1957. In: *Antarctic Meteorology, Proceedings of Symposium held in Melbourne...*, London, Pergamon Press, [c1960], p. 115–27, maps, diagrs. [Synoptic situation described.]

Jackson, C. I. Snowfall measurements in northern Canada. *Quarterly Journal of the Royal Meteorological Society*, Vol. 86, No. 368, 1960, p. 273–75. [Sources of error discussed and longer intervals between measurements advocated.]

Longley, Richmond W. Snow depth and snow density at Resolute, Northwest Territories. *Journal of Glaciology*, Vol. 3, No. 28, 1960, p. 733–38, illus. [Conclusions drawn from observations of snow depth at 21 sites made twice weekly during winter of 1957–58.]

Krenke, A. N., *and* Psareva, T. V. Snezhnyy pokrov [Snow cover]. *Materialy Glyatsiologicheskikh Issledovaniy. Zemlya Frantsa Iosifa* [*Glaciological Observations. Zemlya Frantsa Iosifa*] (Moscow), 1960, 152 p. [Observations in full, 1957–59.]

[Antarctic : Snow Cover] Snezhnyy pokrov [Snow cover]. *Materialy Glyatsiologicheskikh Issledovaniy. Antarktida* [*Glaciological Observations. Antarktica*] (Moscow), 1960, 40 p. [Mainly thickness observations, at stations occupied by 3rd Soviet Antarctic expedition, 1958.]

Kopanev, Ivan Dmitriyevich. *Snezhnyy pokrov Antarktidy* [*Snow cover of Antarctica*]. Leningrad, Gidrometeorologicheskoye Izdatel'stvo [Hydrological and Meteorological Publishing House], 1960. 144 p., illus. 22 cm. [Formation, physical and mechanical properties; influence on weather and climate.]

Kopanev, I. D. Teplovoy rezhim snezhnogo pokrova v Antarktide [Thermal regime of snow cover in Antarctica]. *Izvestiya Akademii Nauk SSSR. Seriya Geofizicheskaya* [*News of the Academy of Sciences of the U.S.S.R. Geophysical Series*], 1959, No. 12, p. 1831–38. [Quantitative measurements of thermal and radiation properties.]

Kotlyakov, V. M., *and* Kuznetsov, M. A. Statsionarnyye issledovaniya v rayone Mirnogo [Studies in the Mirnyy region]. *Materialy Glyatsiologicheskikh Issledovaniy Antarktida* [*Glaciological Observations. Antarctica*] (Moscow), 1960, 168 p. (Snezhnyy pokrov [Snow cover], Vypusk 1.) [Observation in full of 2nd Soviet Antarctic expedition, 1957.]

Kotlyakov, V. M., *and others.* Laboratornyye issledovaniya v Mirnom; statsionarnyye issledovaniya na Pionerskoy [Laboratory studies at Mirnyy. Studies at "Pionerskaya" station. By V. M. Kotlyakov, M. A. Kuznetsov, N. M. Makarov]. *Materialy Glyatsiologicheskikh Issledovaniy. Antarktida* [*Glaciological Observations. Antarctica*] (Moscow), 1960, 152 p. (Snezhnyy pokrov [Snow cover], Vypusk 3.) [Second Soviet Antarctic expedition, 1957.]

Kotlyakov, V. M., *and* Kuznetsov, M. A. Polevyye issledovaniya v beregovoy polose, na shel'fovom lednike Shekltona i na ostrove Drigal'skogo [Field observations in the coastal strip, on the Shackleton Ice Shelf and on Drigalski Island]. *Materialy*

Glyatsiologicheskikh Issledovaniy. Antarktida [*Glaciological Observations. Antarctica*] (Moscow), 1960, 172 p. (Snezhnyy pokrov [Snow cover]. Vypusk 2.) [Observations in full of 2nd Soviet Antarctic expedition, 1957.]

KOTLYAKOV, V. M. Tverdost' i plotnost' poverkhnostnykh sloyev snezhnogo pokrova pribrezhnoy polosy Antarktidy [Hardness and density of surface layers of snow in the coastal strip of Antarctica]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 20, 1960, p. 18–21. [Readings along profile Mirnyy—50 km. inland.]

PRIK, Z. M. Osnovnyye rezul'taty meteorologicheskogo izucheniya Arktiki [Main results of the meteorological study of the Arctic.] *Problemy Arktiki i Antarktiki* [*Problems of the Arctic and Antarctic*], Vypusk 4, 1960, p. 76–90. [Summary of contribution of Arctic and Antarctic Institute, Leningrad during 40 years.]

WEXLER, HARRY. Additional comments on the warming trend at Little America, Antarctica. *Weather*, Vol. 16, No. 2, 1961, p. 56–58, diagr. [Data for 1958 excluded from *idem*, Vol. 14, 1959, p. 191.]

CONOVER, JOHN H. Macro- and microclimatology of the Arctic slope of Alaska. *U.S. Quartermaster Research and Engineering Center, Environmental Protection Research Division, Technical Report* EP-139, 1960, 65 p., maps, tables, diagrs. [Observations from 1952–54 in connexion with coordinated geological, ecological and soil study of region.]

WESTBROOK, JANE HOWE. A method of predicting the frequency distribution of windchill. *U.S. Quartermaster Research and Engineering Center, Environmental Protection Research Division, Technical Report* EP-143, 1961, 42 p., tables, diagrs.

DOLGIN, I. M. Aeroklimaticheskiye issledovaniya v Arktike [Arctic upper air climatological studies]. *Problemy Arktiki i Antarktiki* [*Problems of the Arctic and Antarctic*], Vypusk 4, 1960, p. 64–75. [Summary of present state of knowledge.]

BARRY, R. G. A note on the synoptic climatology of Labrador-Ungava. *Quarterly Journal of the Royal Meteorological Society*, Vol. 86, No. 370, 1960, p. 557–65, tables, diagrs. [Synoptic situations discussed in terms of climatic characteristics by means of a classification of airflow pattern types.]

AURORA AND AIRGLOW

SCHNEIDER, OTTO. Auroras australes vistas en el pasado desde la America del Sur y regiones antárticas adyacentes. *Contribución del Instituto Antártico Argentino*, No. 36, 1959, 45 p., tables. [Historical survey of aurora reported from South America and adjacent Antarctic regions before 1957.]

KIMBALL, D. S. *A study of the aurora of 1859*. College, University of Alaska, Geophysical Institute, 1960. [32] leaves, maps, diagrs. (NSF Grant No. Y/22.6/327. Scientific Report No. 6.) [Collection of world-wide descriptive observations.]

[ARCTIC REGIONS : AURORA] Ergebnisse der Polarlichtbeobachtungen deutscher Schiffe im Internationalen Geophysikalischen Jahr 1957/58 und während der Internationalen Geophysikalischen Kooperation 1959. *Wetterlotse* (Hamburg), 12 Jahrg., Nr. 165, 1960, p. 201–13, diagrs. [Auroral observations from German ships in the northern hemisphere during International Geophysical Year, 1957–59.]

KIM, J. A., *and* CURRIE, B. W. Further observations of the horizontal movements of aurora. *Canadian Journal of Physics*, Vol. 38, No. 10, 1960, p. 1366–75, tables, diagrs. [Data from northern Canada.]

IGNATOV, V. S. Predvaritel'nyye rezul'taty nablyudeniy polyarnykh siyaniy na yuzhnom geomagnitnom polyuse [Preliminary results of auroral observations at the south geomagnetic pole]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 18, 1960, p. 24–27. [Visual and spectral observations in 1959 at "Vostok".]

EGAN, R. D., *and* PETERSON, A. M. Auroral noise at HF. *Journal of Geophysical Research*, Vol. 65, No. 11, 1960, p. 3830–32, diagrs.

HARRISON, E. R. Theory of auroral structures. *Nature*, Vol. 187, No. 4735, p. 383–86.

LIEMOHN, HAROLD. The outer radiation belt and aurorae. *Nature*, Vol. 188, No. 4748, p. 394–95, illus. table. [Discussion of diurnal latitude variation.]

O'BRIEN, B. J., *and others*. Correlation of an auroral arc and a subvisible monochromatic 6300 A arc with outer-zone radiation on November 28, 1959. By B. J. O'Brien, J. A. Van Allen, F. E. Roach and C. W. Gartlein. *Journal of Geophysical Research*, Vol. 65, No. 9, 1960, p. 2759–66, diagrs. [North America.]

ANDERSON, K. A., *and* ENEMARK, D. C. Balloon observations of X rays in the auroral zone II. *Journal of Geophysical Research*, Vol. 65, No. 11, 1960, p. 3521–38, diagrs. [Several flights during August 1959 from College, Alaska and Fort Churchill, Manitoba.]

ROACH, F. E., *and* REES, M. H. The absolute zenith intensity of [OI] 5577 at College, Alaska. *Journal of Geophysical Research*, Vol. 65, No. 5, 1960, p. 1489–93, tables, diagrs.

WEILL, GILBERT. Sur la réparation des ions N_2^+ dans la haute atmosphère antarctique. *Annales de Géophysique*, Tome 16, No. 2, 1960, p. 223–35, diagrs. [Twilight photometry of 3914 Å radiation in Terre Adélie.]

DELANNOY, J. Sur les observations crépusculaires de la raie du lithium au cours de l'Année Géophysique Internationale. *Annales de Géophysique*, Tome 16, No. 2, 1960, p. 236–52, diagrs. [Twilight photometry of 6708 Å radiation in Terre Adélie, 1957–58.]

MCINNES, B., *and* ROBERTSON, K. A. Aurora. *Marine Observer*, Vol. 30, No. 190, 1960, p. 198–99, tables. [Auroral observations from ships October–December 1959.]

MCILWAIN, CARL E. Direct measurement of particles producing visible auroras. *Journal of Geophysical Research*, Vol. 65, No. 9, 1960, p. 2727–47, illus., diagrs. [Rocket flights at Fort Churchill Canada, show 75 % excitation to be due to electrons.]

HATHERTON, T., *and* MIDWINTER, G. G. Observations of the Aurora Australis at New Zealand Antarctic stations during I.G.Y. *Journal of Geophysical Research*, Vol. 65, No. 5, 1960, p. 1404–11, diagrs.

GADSEN, M. Studies of the upper atmosphere from Invercargill, New Zealand. Part 5. The frequency of occurrence of aurorae and its dependence on magnetic activity and temporal functions. *Annales de Géophysique*, Tome 16, No. 4, 1960, p. 88–104, diagrs.

STRATIGRAPHY

RAVICH, M. G., *and* KRYLOV, A. YA. Ob absolyutnom vozraste porod vostochnoy chasti gor na Zemle Korolevy Mod [Absolute age of rocks of the eastern part of the Dronning Maud Land mountains.] *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 20, 1960, p. 15–17.

STARIK, I. YE., *and others*. Ob absolyutnom vozraste porod vostochno-antarkticheskoy platformy [Absolute age of rocks of the eastern Antarctic platform. By I. Ye. Starik, M. G. Ravich, A. Ya. Krylov, Yu. I. Silin]. *Doklady Akademii Nauk SSSR* [*Reports of the Academy of Sciences of the U.S.S.R.*], Tom 126, No. 1, 1959, p. 144–46. [Samples from coastal areas in Australian Antarctic Territory and Dronning Maud Land.]

BLACKADAR, R. G., *and* FRASER, J. A. Precambrian geology of Arctic Canada, a summary acount. *Geological Survey of Canada, Paper* 60–8, 1960, 24 p., maps, diagrs., tables.

MAGNUSSON, NILS H. Age determinations of Swedish Precambrian rocks. *Geologiska Föreningens i Stockholm Förhandlingar*, Bd. 82, No. 503, 1960, Hft. 4, p. 407–32, maps. [Based on determinations made at geological institutes in Leningrad and Kiev. Includes north Sweden.]

RAVICH, M. G., *and* KRYLOV, A. YA. Absolyutnyy vozrast porod v rayone stantsii Mouson [Absolute age of rocks in the region of Mawson]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 19, 1960, p. 8–9.

HEUSSER, CALVIN J. *Late-Pleistocene environments of North Pacific North America; an elaboration of Late-Glacial and Postglacial climatic, physiographic and biotic changes*. New York, American Geographical Society, 1960. xix, 308 p., illus., maps, tables, diagrs. 25½ cm. (*American Geographical Society Special Publication* No. 35). [Research done in field seasons between 1950–58.]

LAVROVA, MARIYA ALEKSEYEVNA. *Chetvertichnaya geologiya Kol'skogo poluostrova* [*Quaternary geology of Kol'skiy Poluostrov*]. Moscow, Leningrad, Izdatel'stvo Akademii Nauk SSSR [Publishing House of the Academy of Sciences of the U.S.S.R.], 1960. 234 p., illus., maps, 27 cm.

PERSHINA, A. I. *Stratigrafiya i paleogeografiya devonskikh otlozheniy pravoberezh'ya sredney Pechory i yuzhnoy chasti gryady Chernysheva* [*Stratigraphy and palaeogeography of the Devonian deposits of the right bank of the middle Pechora and the south part of the Chernysheva ridge*]. Moscow, Leningrad, Izdatel'stvo Akademii Nauk SSSR [Publishing House of the Academy of Sciences of the U.S.S.R.], 1960. 144 p. 27 cm.

PETROLOGY

BERTHELSEN, ASGER, *and* BRIDGWATER, DAVID. On the field occurrence and petrography of some basic dykes of supposed Pre-Cambrian age from the southern Sukkertoppen district, western Greenland. *Meddelelser om Grønland*, Bd. 123, Nr. 3, 1960, 43 p., illus., maps, 3 plates. (Grønlands Geologiske Undersøgelse.) [Field work in 1949, 1953, 1954, 1956 and 1957.]

BERTHELSEN, ASGER. Structural studies in the Pre-Cambrian of western Greenland. 2. Geology of Tovqussap Nunâ. *Meddelelser om Grønland*, Bd. 123, Nr. 1, 1960, 223 p., illus., maps, 4 plates in folder. [Based on field (1949, 1953, 1954, 1956, 1957) and laboratory work by author. Russian summary.]

DREVER, HARALD I. Immiscibility in the Picritic intrusion at Igdlorssuit, west Greenland. *Report of the International Geological Congress*, 21st Session, Norden, 1960, Part 13, p. 47–58, illus., map. [Description and interpretation of a globular structure believed to be evidence of silicate immiscibility.]

GARBOE, AXEL. Meteoriter fra Grønland. Lidt om fund og hjemtransport. *Grønland*, 1961, Nr. 2, p. 41–48, illus. [Transport to Denmark of meteorite found near Kap York in Melville Bugt, north Greenland by Knud Rasmussen in 1913.]

KAPP, HANS. Zur Petrologie der Subvulkane zwischen Mesters Vig and Antarctic Havn (Ost-Grönland). *Meddelelser om Grønland*, Bd. 153, Nr. 2, 1960, 203 p., illus., maps, 12 plates. (De Danske Ekspeditioner til Østgrønland 1947–58. Under ledelse af Lauge Koch.) [Petrology of four igneous complexes, Scoresby Land, east Greenland. Based on field work in 1957 and 1958. English summary.]

UPTON, B. G. J. The alkaline igneous complex of Kûngnât Fjeld, south Greenland. *Meddelelser om Grønland*, Bd. 123, Nr. 4, 1960, 145 p., illus., maps, 6 plates. (Grønlands Geologiske Undersøgelse.) [Based on field work in 1955, 1956 and 1957.]

GALAKHOV, ALEKSANDR VASIL'YEVICH. *Rischorrity Khibinskogo shchelochnogo massiva* [*Rischorrites of the Khibiny alkaline massif*]. Moscow, Leningrad, Izdatel'stvo Akademii Nauk SSSR [Publishing House of the Academy of Sciences of the U.S.S.R.], 1959. 171 p., illus., maps. 23 cm. [Geological structure of intrusion, petrography, origin.]

SCHWARZACHER, WALTER, *and* HUNKINS, KENNETH. *Dredged gravels from the central Arctic Ocean*. Palisades, N.Y., Columbia University, Lamont Geological Observatory, 1960. [28] p., illus., diagrs., tables. 28 cm. (Scientific Report No. 2AF 19(604)2030.) [Trawls made from Drifting Station Alpha between lat. 84°–85° N. and long. 138°–152° W.]

ECONOMIC GEOLOGY. MINERALS

PUSTOVALOV, L. V., *ed. Razvitiya proizvoditel'nykh sil Vostochnoy Sibiri. Geologicheskoye stroyeniye* [*Development of productive forces of eastern Siberia. Geological structure*]. Moscow, Izdatel'stvo Akademii Nauk SSSR [Publishing House of the Academy of Sciences of the U.S.S.R.], 1960. 152 p., maps. 27 cm. [Economic geology. Papers given at conference in 1958.]

VINCENT, E. A. Ulvöspinel in the Skaergaard Intrusion, Greenland. *Neues Jahrbuch für Mineralogie. Abhandlungen*, Bd. 94, 1960, p. 993–1016, illus., 6 plates. [East Greenland. German summary.]

SERDYUCHENKO, D. P., *and others. Zheleznyye rudy yuzhnoy Yakutii. Geologiya, mineralogiya, genezis i promyshlennoye znacheniye* [*Iron ores of southern Yakutiya. Geology, mineralogy, genesis, industrial significance. By D. P. Serdyuchenko, A. V. Glebov, M. I. Kadenskaya, Ye. P. Leonova, A. A. Kadenskiy, V. A. Pavlov*]. Moscow, Izdatel'stvo Akademii Nauk SSSR [Publishing House of the Academy of Sciences of the U.S.S.R.], 1960. 519 p., illus., maps. 27 cm.

SÆBØ, PER CHR., *and others*. Note on "birds-eye" textures in some Norwegian pyrrhotite-bearing ores. By Per Chr. Sæbø, Thor L. Sverdrup and Harald Bjørlykke. *Norges Geologiske Undersøkelse*, Nr. 211, Årbok 1959 (pub. 1960), p. 205–11, illus., map. [Includes specimen from Rana, Nordland, north Norway. Summary in Norwegian.]

CHAYKOVSKIY, VASILIY KONSTANTINOVICH. *Geologiya olovonosnykh mestorozhdeniy severo-vostoka SSSR* [*Geology of tin deposits of the north-east of the U.S.S.R.*]. Moscow, Gosudarstvennoye Nauchno-Tekhnicheskoye Izdatel'stvo Literatury po Geologii i Okhrane Nedr [State Scientific and Technical Publishing House for Literature on Geology and Conservations of Resources], 1960. 335 p., maps. 23 cm.

MARMO, VLADI. Serpentinite of Pahta-Autsi, Finnish Lapland. *Bulletin de la Commission Géologique de Finlande*, No. 188, 1960, 5, p. 67–76, illus., maps. [Results of detailed studies (geology, petrology, magnetite veinlets, chemistry) at the southern end of Pahtajärvi, 1959.]

LAPINA, N. N., *ed.* Litologicheskaya kharakteristika porod i sostav ugley Lenskogo basseyna [Lithological characteristics of the rocks and the composition of the coal of the Lena basin]. *Trudy Nauchno-Issledovatel'skogo Instituta Geologii Arktiki* [*Transactions of the Research Institute of the Geology of the Arctic*], Tom 112, 1960, 189 p., illus. [Chiefly on Sangara and Chay-Tumus deposits.]

YEVSEYEV, V. N., *and* KONOVALENKO, V. G. Novyye vozmozhnosti resheniya toplivnoy problemy na kraynem severe [New possibilities for solution of the fuel problem in the extreme north]. *Geografiya i Khozyaystvo* [*Geography and Economy*] (*Moscow*), Sbornik 6, 1960, p. 18–26, illus., map. [Use of local peat urged.]

Goloushin, N. S., *and* Puk, P. S. Kharakteristika neftey Leno-Khatangskoy oblasti [Characteristics of the oils of the Lena–Khatanga region]. *Trudy Nauchno-Issledovatel'skogo Instituta Geologii Arktiki* [*Transactions of the Research Institute of the Geology of the Arctic*], Tom 114, 1960, p. 185–98. [Analysis of oil from 24 boreholes in region.]

PALAEONTOLOGY

Manum, Svein. Some Dinoflagellates and Hystrichosphaerids from the Lower Tertiary of Spitsbergen. *Norsk Polarinstitutt. Meddelelser*, Nr. 85, 1960, 25 p., illus., 1 plate. [Based on samples from Sarsbukta, Forlandsundet, Vestspitsbergen, collected by Rolf W. Feyling-Hanssen, 1950. Includes one new form, *Svalbardella cooksoniae*.]

McCammon, Helen. Fauna of the Manitoba group in Manitoba. *Manitoba Department of Mines and Natural Resources, Mines Branch, Publication* 59–6, 1960, 109 p., illus., tables. [Devonian fossils.]

Frebold, Hans. The Jurassic faunas of the Canadian Arctic, Lower Jurassic and Lowermost Middle Jurassic ammonites. *Geological Survey of Canada, Bulletin* 59, 1960, 33 p., illus., maps, tables. [Fossil collections made between Ellesmere Island and Aklavik.]

Imlay, Ralph W. Early Cretaceous (Albian) ammonites from the Chitina Valley and Talkeetna Mountains, Alaska. *U.S. Geological Survey Professional Paper* 354-D, 1960, p. 87–114, illus., maps, tables. [Early Cretaceous (Albian) ammonites in southern Alaska have strong affinities with those in California and Oregon, but are in part of Boreal and Eurasian origin.]

Copeland, M. J., *and* Bolton, Thomas E. Canadian fossil Arthropoda Eurypterida, Phyllocarida and Decapoda. *Geological Survey of Canada, Bulletin* 60, 1960, 84 p., illus., maps, tables. [7 new and 12 previously unrecorded specimens. Stratigraphic and geographic distribution discussed.]

Heintz, Natascha. The Downtonian and Devonian vertebrates of Spitsbergen. X. Two new species of the genus *Pteraspis* from the Wood Bay series in Spitsbergen. *Norsk Polarinstitutt. Skrifter*, Nr. 117, 1960, 13 p., illus. [Fish fossils from Vestspitsbergen.]

Zhuravleva, Inessa Tikhonovna. *Arkheotsiaty Sibirskoy platformy* [*Archaeocyathi of the Siberian platform*]. Moscow, Izdatel'stvo Akademii Nauk SSSR [Publishing House of the Academy of Sciences of the U.S.S.R.], 1960. 344 p., illus. 27 cm. [Systematics of class of fossil organisms of doubtful taxonomic position.]

BIOLOGY. ARCHAEOLOGY. ANTHROPOLOGY

[Alaska : Nuclear Fall-Out] Project chariot—the long look. *Alaska Conservation Society News Bulletin* (College), Vol. 11, No. 2, 1961, p. 1–27. [Proposed construction of harbour at Cape Thompson using nuclear explosives and their possible adverse effect on population, flora and fauna.]

Ellis, Derek V. Marine infaunal benthos in Arctic North America. *Arctic Institute of North America Technical Paper* No. 5, 1960, 53 p., illus., maps. [Collecting techniques and annotated list of species collected north Baffin Island, Greenland and Foxe Basin, 1954–57.]

Gollerbakh, M. M., *and* Syroyechkovskiy, Ye. Ye. Biogeograficheskiye issledovaniya v vostochnoy Antarktide v letniy sezon 1957 g. [Biogeographical studies in eastern Antarctica in summer, 1957]. *In*: Treshnikov, A. F., *ed. Vtoraya kontinental'naya ekspeditsiya 1956–1958 gg. Nauchnyye rezul'taty* [*Second continental expedition, 1956–58. Scientific results*] (Leningrad, 1960) [numbered "9"], p. 197–207. [Notes on flora and fauna in coastal areas between long. 85° and 105° E.]

Meldgaard, Jørgen. Sarqaq-folket ved Itivnera. Nationalmuseets undersøgelser i sommeren 1960. *Grønland*, 1961, Nr. 1, p. 15–23, illus. [Investigations in 1960 of remains of Sarqaq culture, carried out by Nationalmuseet, København, at Itivnera, Godthaab district, west Greenland.]

Macneish, Richard S. Archaeological activities in the south-west Yukon. *Arctic Circular*, Vol. 13, No. 2, 1960, p. 22–25. [1960. Attempt to discover complete archaeological sequence in limited area, at 7 different sites.]

Maxwell, Moreau S. An archaeological analysis of eastern Grant Land, Ellesmere Island, Northwest Territories. *National Museum of Canada Bulletin*, No. 170, 1960, 109 p., illus., map. [1958 field season.]

Beckman, Lars. Om variationen av brun ögonfärg i norra Sverige. *Ymer*, Årg. 80, Hft. 4, 1960, p. 256–59, maps. [Incidence of brown eyes among recruits and Lapps in north Sweden.]

PRINCE, ALTON E., *and* BAKANAUSKAS, SAM. Airborne viable micro-organism spores collected near sea level. *In*: BUSHNELL, VIVIAN, *ed. Scientific Studies at Fletcher's Ice Island, T-3 1952–1955*, Vol. 3, 1960, p. 92–124, illus., table. [First sampling for living micro-organisms at or very near sea level at approximately 83° N. showed very limited number present.]

FLINT, ELIZABETH A., *and* STOUT, J. D. Microbiology of some soils from Antarctica. *Nature*, Vol. 188, No. 4752, 1960, p. 767–68. [Note on microflora and microfauna found in McMurdo Sound area.]

LEBEDEVA, M. N. Mikrobiologicheskiye issledovaniya [Microbiological studies]. *In*: MAKSIMOV, I. V., *ed. Vtoraya morskaya ekspeditsiya na d/e "Ob'", 1956–1957 gg. Nauchnyye rezul'taty* [*Second marine expedition in the Diesel-electric ship Ob', 1956–57. Scientific results*] (Leningrad, 1960), [numbered "7"], p. 153–64. [Indian Ocean.]

BEKLEMISHEV, K. V. Issledovaniya fitoplanktona [Phytoplankton studies]. *In*: MAKSIMOV, I. V., *ed. Vtoraya morskaya ekspeditsiya na d/e "Ob'", 1956–1957 gg. Nauchnyye rezul'taty* [*Second marine expedition in the Diesel-electric ship Ob'. 1956–57. Scientific results*] (Leningrad, 1960), [numbered "7"], p. 143–52. [South Indian Ocean.]

KOROTKEVICH, V. S., *and* BEKLEMISHEV, K. V. Issledovaniya zooplanktona [Zooplankton studies]. *In*: MAKSIMOV, I. V., *ed. Vtoraya morskaya ekspeditsiya na d/e "Ob'", 1956–1957 gg. Nauchnyye rezul'taty* [*Second marine expedition in the Diesel-electric ship Ob', 1956–57. Scientific results*] (Leningrad, 1960), [numbered "7"], p. 111–25. [Distribution of species in South Indian Ocean.]

BOTANY

STEERE, WILLIAM CAMPBELL. Botanical problems in Arctic America. *Plant Science Bulletin*, October 1960, p. 1–8, (Reprint). [Present research problems.]

GJAEREVOLL, OLAV. Fra en ekskursjon til White Mts. i Sentral-Alaska. *Polarboken*, 1959–60, p. 34–44, illus. [Botanical observations by author in White Mountains, central Alaska, 1953.]

HAFSTEN, ULF. Pleistocene development of vegetation and climate in Tristan da Cunha and Gough Island. *Universitetet i Bergen. Årbok. Mat.-Naturv. Serie*, Nr. 20, 1960, 48 p., illus., plates, maps. [Pollen analysis and radiocarbon dating show that no major vegetational or climatic changes have occurred on Tristan or Gough in last 5000 years.]

DOROGOSTAYSKAYA, YE. V. O smenakh rastitel'nosti v svyazi s termokarstom na severe Yakutii [Changes of vegetation in connexion with thermokarst in the north of Yakutiya]. *Izvestiya Sibirskogo Otdeleniya Akademii Nauk SSSR* [*News of the Siberian Branch of the Academy of Sciences of the U.S.S.R.*], 1959, No. 12, p. 91–100. [Plant succession during erosion of thermokarst terrain in Lena delta.]

DIXON, H. N. Mosses of Tristan da Cunha. *Results of the Norwegian Scientific Expedition to Tristan da Cunha 1937–38*, No. 48, 1960, 49 p. [128 species recorded, 59 being endemic, 35 present also in Fuegia and 23 in sub-antarctic islands. South African affinity is small.]

ZOOLOGY

BEKLEMISHEV, K. V., *and* PARIN, N. V. Biogeograficheskiye granitsy v pelagiali severnoy chasti Tikhogo okeana zimoy 1958/59 g. [Biogeographic boundaries in the northern Pacific, winter 1958–59]. *Trudy Instituta Okeanologii* [*Transactions of the Institute of Oceanology*], Tom 41, 1960, p. 257–65, maps.

SKARLATO, OREST ALEKSANDROVICH. *Dvustvorchatyye mollyuski dal'nevostochnykh morey SSSR* (*otryad Dysodonta*) [*Bivalve molluscs of the far eastern seas of the U.S.S.R.* (*Dysodonta*)]. Moscow, Leningrad, Izdatel'stvo Akademii Nauk SSSR [Publishing House of the Academy of Sciences of the U.S.S.R.], 1960. 151 p., illus. 27 cm. (Opredeliteli po faune SSSR [Classified lists of fauna of the U.S.S.R.], No. 71.) [Systematics.]

SOOT-RYEN, T. Pelecypods from Tristan da Cunha. *Results of Norwegian Scientific Expedition to Tristan da Cunha 1937–1938*, No. 49, 1960, 47 p., illus., tables. [10 species recorded, 6 being new: 17 pelecypods now known from these islands.]

HILLIARD, DOUGLAS K. Studies on the helminth fauna of Alaska. 38. The taxonomic significance of eggs and coracidia of some diphyllobothriid cestodes. *Journal of Parasitology*, Vol. 46, No. 6, 1960, p. 703–16, illus., diagrs., tables. [11 species collected. Study of eggs and coracidia undertaken to investigate their possible taxonomic significance.]

LUTHER, ALEX. Die Turbellarien Ostfennoskandiens. 1. Acoela, Catenulida, Macrostomida, Lecithoepitheliata, Prolecithophora, und Proseriata. *Fauna Fennica*, 7, 1960, 155 p., illus., map. [Systematic list of Turbellaria (descriptions, distribution) recorded in Finland and north-west Russia.]

Vinogradov, M. Ye. Novyy vid Chuneolidae (Amphipoda, Crustacea) iz severo-zapadnoy chasti Tikhogo okeana [New species of Chuneolidae (Amphipoda, Crustacea) from the north-west Pacific]. *Trudy Instituta Okeanologii* [*Transactions of the Institute of Oceanology*], Tom 41, 1960, p. 248–53, illus. [*Chuneola spinifera* described.]

Rand, R. W. The biology of guano-producing sea-birds: the distribution, abundance and feeding-habits of the Cape Penguin, *Spheniscus demersus*, off the south-western coast of the Cape Province. *Union of South Africa, Department of Commerce and Industries Division of Fisheries, Investigational Report* No. 41, 1960, 28 p., illus., maps, tables. (Reprint from *Commerce and Industry*, March 1960.)

Morison, Guy D. Thysanoptera of Tristan da Cunha. *Results of the Norwegian Scientific Expedition to Tristan da Cunha 1937–38*, No. 47, 1960, 5 p., illus. [2 species listed, one being new and the other cosmopolitan.]

[Antarctica : Insects] Air-borne organisms in the Antarctic area. *Pacific Science Association, Information Bulletin*, Vol. 12, No. 5, 1960. [Study of air-borne insects from New Zealand being carried out by Bernice P. Bishop Museum, Honolulu.]

Lindberg, Håkan, *and* Ossiannilsson, Frej. Verzeichnis der ostfennoskandischen Homoptera psyllina. *Fauna Fennica*, 8, 1960, 23 p., map. [Systematic list of *Homoptera psyllina* recorded in Finland and north-west Russia.]

Arsen'yev, V. A. Nablyudeniya nad morskimi zhivotnymi i ptitsami Antarktiki [Observations of marine animals and birds of the Antarctic]. *In*: Maksimov, I. V., *ed. Vtoraya morskaya ekspeditsiya na d/e "Ob'", 1956–1957 gg. Nauchnyye rezul'taty* [*Second marine expedition in the Diesel-electric ship Ob', 1956–57. Scientific results*] (Leningrad, 1960), [numbered "7"], p. 85–96. [Whales, seals and birds observed in south Indian Ocean.]

Zhukov, Ye. V., *ed.* Materialy po parazitologii ryb dal'nevostochnykh morey [Material on the parasitology of fish of the Far Eastern seas]. *Trudy Zoologicheskogo Instituta* [*Transactions of the Zoological Institute*], Tom 28, 1960, 256 p. [Endoparasitic worms of fish in North Pacific.]

Barsukov, V. V., *and* Permitin, Yu. Ye. Ikhtiologicheskiye issledovaniya [Ichthyological studies]. *In*: Maksimov, I. V., *ed. Vtoraya morskaya ekspeditsiya na d/e "Ob'", 1956–1957 gg. Nauchnyye rezul'taty* [*Second marine expedition in the Diesel-electric ship Ob', 1956–57. Scientific results*] (Leningrad, 1960), [numbered "7"], p. 97–104. [Species collected in Indian Ocean.]

Dragesund, Olav, *and* Hognestad, Per. Småsildundersøkelsene og småsildfisket 1959/60. *Fisken og Havet*, 1960, Nr. 3, 12 p., illus., maps. [Distribution of young herring in Norwegian Sea and Barents Sea in winter of 1959–60; tagging experiments; catches 1941–60. English summary.]

Hylen, Arvid, *and others*. Torskeundersøkelsene i Lofoten og i Barentshavet 1960. By Arvid Hylen, Lars Midttun and Gunnar Sætersdal. *Fisken og Havet*, 1961, Nr. 2, 14 p., illus., maps. [Investigation of age distribution, stocks and distribution of cod in Lofoten and Barents Sea, 1960. English summary.]

Parmelee, David F., *and* Macdonald, S. D. The birds of west-central Ellesmere Island and adjacent areas. *Canada, National Museum Bulletin*, No. 169, *Biological Series* No. 63, 1960, 103 p., illus., maps, tables. [Ellesmere Island and Axel Heiberg Island 1955.]

Kessel, Brina, *and* Schaller, George B. Birds of the Upper Sheenjek Valley, north-eastern Alaska. *Biological Papers of the University of Alaska*, No. 4, 1960, 59 p., illus., map, tables. [Annotated list of birds seen June to July, 1956.]

Johansen, Hans. Revision und Entstehung der arktischen Vogelfauna. Zweiter Teil. Revision der Grues-Passeres und Entstehung der arktischen Vogelfauna. *Acta Arctica*, Fasc. 9, 1958, 131 p., maps. [Distribution in Arctic and origin of *Grues. Laro-Limicolae, Striges, Passeres*; systematic list of bird species breeding regularly in Arctic, origins of Arctic bird fauna in general. Summary in English.]

Koskimies, Jukka, *and* Rajala, Paavo. Game marking by the Finnish Game Foundation, 1947–1956. *Riistatieteellisiä Julkaisuja*, [*Papers on Game Research*], No. 20, 1959, p. 1–16, illus., tables.

Nordström, Göran. Die Vogelberingung in Finnland im Jahre 1958. *Memoranda Societatis pro Fauna et Flora Fennica*, 35, 1958–59 (pub. 1960), p. 2–63. [Bird ringing in Finland in 1958. Lists number of each species, place of ringing and recoveries up to May 31, 1959; includes north Finland.]

Holgersen, Holger, *ed.* Ringmerkingsnummer. *Sterna*, Bd. 4, Hft. 5, 1961, p. 177–228, illus. [Bird-banding and recoveries, Norway, 1959. English summary.]

Pitelka, Frank A. Numbers, breeding schedule, and territoriality in Pectoral Sandpipers of northern Alaska. *Condor*, Vol. 61, No. 4, 1959, p. 233–64. [*Erolia melanotos*. Population characteristics of breeding ground.]

Sapin-Jaloustre, Jean. *Écologie du manchot Adélie*, Paris, Hermann, [©1960], 208 p., illus., maps, tables, 24 cm. (Expéditions Polaires Françaises Publication No. 208.) [*Pygoscelis adeliae* observed Terre Adélie 1948–51.]

LEDENEV, V. G. Novaya koloniya imperatorskikh pingvinov [New colony of Emperor penguins]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 23, 1960, p. 37–38, map. [Sighted from air near "Lazarev" station, Dronning Maud Land.]

HARRINGTON, H. J. Adelie Penguin rookeries in the Ross Sea region. *Notornis*, Vol. 9, No. 2, 1960, p. 33–39. [*Pygoscelis adeliae*. Work done from 1957–58 to 1958–59 seasons.]

HAFTORN, SVEIN. Et glimt fra zoologiske undersøkelser i Alaska. *Polarboken*, 1959–60, p. 55–58, illus. [Food storing technique of Boreal Chickadee (*Parus hudsonicus*), Alaska.]

SPANGENBERG, YE. P. Zimniye zalety teterevyatnikov v tundru [Arrival of Goshawk in the tundra in winter]. *Byulleten' Moskovskogo Obshchestva Ispytateley Prirody. Novaya Seriya. Otdel Biologicheskiy* [*Bulletin of the Moscow Society of Naturalists. New Series. Biological Section*], Tom 65, Vypusk 4, 1960, p. 122–23. [*Accipiter gentilis* observed in Poluostrov Kanin.]

CAMPBELL, JOHN M. Nesting of the Golden Eagle in the central Brooks Range of Arctic Alaska. *Condor*, Vol. 62, No. 4, 1960, p. 298. [*Aquilla chrysaëtos* found breeding in 1959.]

HAGEN, YNGVAR. Snøugla på Hardangervidda sommeren 1959. The Snowy Owl on Hardangervidda in the summer of 1959. *Meddelelser fra Statens Viltundersøkelser*, 2. Serie, Nr. 7, 1960, 25 p., 6 plates. [*Nyctea scandiaca*. South Norway. English summary.]

KULIK, I. L., *and* NIKITINA, N. A. Fauna melkikh mlekopitayushchikh lesnoy zony Komi ASSR. [Small mammals of the forest zone of Komi A.S.S.R.] *Byulleten' Moskovskogo Obshchestva Ispytateley Prirody. Novaya Seriya. Otdel Biologicheskiy* [*Bulletin of the Moscow Society of Naturalists. New Series. Biological Section*], Tom 65, Vypusk 6, 1960, p. 3–16. [Distributions, habitat, behaviour, based on field work in 1958–59.]

OPPENHEIMER, GERALD J. Reference sources for marine mammalogy. *U.S. Fish and Wildlife Service, Special Scientific Report—Fisheries*, No. 361, 1960, 9 p.

KOSHKINA, T. V., *and* KHALANSKIY, A. S. Massovoye razmnozheniye norvezhskikh lemmingov na yuge Kol'skogo poluostrova [Mass reproduction of Norwegian lemmings in the south of Kol'sliy Poluostrov]. *Byulleten' Moskovskogo Obshchestva Ispytateley Prirody. Novaya Seriya. Otdel Biologicheskiy* [*Bulletin of the Moscow Society of Naturalists. New Series. Biological Section*], Tom 65, Vypusk 4, 1960, p. 112–14. [Increase in numbers of *Lemmus lemmus* in 1957–58.]

LAVROV, N. P. Selections from "Acclimatization of Musk rats in the USSR". *Canada, Department of Northern Affairs and National Resources, Translations of Russian Game Reports* Vol. 7, 1960, 150 p., maps, tables.

ARTIMO, ATSO. The dispersal and acclimatization of the muskrat, *Ondatra zibethicus* (L.), in Finland. *Riistatieteellisiä Julkaisuja* [*Papers on Game Research*], No. 21, 1960, 101 p., maps, diagrs.

CURRY-LINDAHL, KAI. Lämmelår i fjällen. *Sveriges Natur*, 1960, [nr.] 6, p. 203–07, illus. [Occurrence of lemming (*Lemmus lemmus*) in Sweden and Norway 1960.]

KAPITONOV, V. I. Ekologiya chernoshapochnogo surka (*Marmota camtschatica* Pall.) [Ecology of the marmot (*Marmota camtschatica* Pall.)] *Byulleten' Moskovskogo Obshchestva Ispytateley Prirody. Novaya Seriya. Otdel Biologicheskiy* [*Bulletin of the Moscow Society of Naturalists. New Series. Biological Section*], Tom 65, Vypusk 4, 1960, p. 114–15. [Observations near mouth of Lena, 1955–57.]

HILL, J. E. Rats and mice from the islands of Tristan da Cunha and Gough, South Atlantic ocean. *Results of the Norwegian Scientific Expedition to Tristan da Cunha 1937–38*, No. 46, 1959, 5 p., tables. [Two rat subspecies established on Tristan and mice (*Mus musculus*) on Tristan and Gough.]

GILMORE, RAYMOND M. A census of the California grey whale. *U.S. Fish and Wildlife Service, Special Scientific Report: Fisheries* No. 342, 1960, 30 p., illus., maps, tables, diagrs. [*Eschrichtius gibbosus*.]

ZEMSKY, V. A. Preparations from ear plugs of baleen whales. *Norsk Hvalfangst-Tidende*, Årg. 49, Nr. 9, 1960, p. 434–35. [New method of preparation of permanent dry slides from ear plugs. In English and Norwegian.]

ICHIHARA, TADAYOSHI. Blue whales in the waters around Kerguelen Island. *Norsk Hvalfangst-Tidende*, Årg. 50, Nr. 1, 1961, p. 1–16, 18–20, illus., map. [Analysis of catch of *Balaenoptera musculus* by Japanese whaling fleet March 17–26, 1960: body colour, size distribution, body proportions, sexual maturity, pregnancy and foetuses, baleen plates and food, age composition, occurrence.]

DAWBIN, W. H. The composition of the New Zealand whale catch in 1959. *Norsk Hvalfangst-Tidende*, Årg. 49, Nr. 9, 1960, p. 401–09. [Sex ratio, immature whales, length, ovulation counts, pregnant whales, segregation (*Megaptera nodosa*). In English and Norwegian.]

GILMORE, RAYMOND M. Census and migration of the California gray whale. *Norsk Hvalfangst-Tidende*, Årg. 49, Nr. 9, 1960, p. 409–10, 413–14, 417–18, 420, 423–31, illus., maps. [*Rhachianectes glaucus*. Results of censuses from 1951; hypothetical migration paths following ocean currents. In English and Norwegian.]

[Physeteridae] Hermaphrodite sperm whale. *Norsk Hvalfangst-Tidende*, Årg. 49, Nr. 9, 1960, p. 433, illus. [Catch of hermaphrodite Sperm Whale (*Physeter catodon*) in Antarctic, 1959. In English and Norwegian.]

Pitts, Grover C. A study of gross body composition of small Alaskan mammals as compared with those from the temperate zone. 1. *Arctic Aeromedical Laboratory* (*Ladd Air Force Base, Alaska*) *Technical Report* 57-46, 1960, 13 p., tables, diagrs.

[Finland : Forest Injuries and Protection] Hirvivahinkokomitean mietintö. *Silva Fennica*, No. 106, 1960, 57 p., illus., maps. [Report of Committee on damage to growing forest by Moose [*Alces alces*]. Includes north Finland. Summary in English.]

Banfield, A. W. F. The use of caribou antler pedicels for age determination. *Journal of Wildlife Management*, Vol. 24, No. 1, 1960, p. 99–102, illus., tables.

Pruitt, William O., *jr.* Behaviour of the Barren-ground caribou. *Biological Papers of the University of Alaska*, No. 3, 1960, 43 p., illus., map. [*Rangifer arcticus arcticus* studied in Manitoba, Saskatchewan and Northwest Territories, 1957–58.]

Banfield, A. W. F., *and* Novakowski, N. S. The survival of the wood bison (*Bison bison athabascae* Rhoads) in the Northwest Territories. *National Museum of Canada, Natural History Papers*, No. 8, 1960, 6 p., illus., maps, tables.

Lønø, Odd. Moskusoksene, en ny dyreart for Svalbard. *Polarboken*, 1959–60, p. 123–30, map. [Introduction and development of Musk Ox (*Ovibos moschatus*) in Svalbard.]

Khuzin, R. Sh. Otlov i okhrana belogo medvedya [Capture and preservation of polar bear]. *Priroda* [*Nature*], 1960, No. 10, p. 54–56, map, illus. [*Thalarctos maritimus*. Method of capturing cub alive without killing mother.]

Kenyon, Karl W., *and* Spencer, David L. Sea otter population and transplant studies in Alaska, 1959. *U.S. Fish and Wildlife Service, Special Scientific Report—Wildlife*, No. 48, 1960, 29 p., illus., map, tables. [*Enhydra lutris*; requirements during captivity and transportation described; suitable places for future transplants discussed.]

Hewer, H. R. Age determination of seals. *Nature*, Vol. 187, No. 4741, 1960, p. 959–60. [Possible errors in use of cementum rings in canine rings of Phocidae.]

Yevteyev, S. A., *and* Arsen'yev, V. A. Yeshche odna zagadka Antarktidy [Another riddle of Antarctica]. *Priroda* [*Nature*], 1960, No. 7, p. 114–15. [Seal remains found on Scott Glacier and in Bunger Hills.]

Wilke, Ford. The northern fur seal. *Alaska Sportsman*, Vol. 26, No. 12, 1960, p. 16–18, illus. [*Callorhinus ursinus* in Pribilof Islands.]

Niggol, Karl. Early mortality in fur seals according to sex. *Journal of Wildlife Management*, Vol. 24, No. 4, 1960, p. 428–29, tables. [*Callorhinus ursinus*; unpublished field data obtained at sea off west coast of North America, off Japan and on Pribilof Islands.]

Sergeant, D. E., *and* Fisher, H. D. Harp Seal populations in the western North Atlantic from 1950 to 1960. *Fisheries Research Board of Canada, Arctic Unit, Circular* No. 5, 1960, 58 leaves, tables, diagrs. [*Phoca groenlandica*.]

Kondakov, N. N. K voprosu o sistematicheskom polozhenii Baykal'skogo tyulenya [Systematic status of the Baykal seal]. *Byulleten' Moskovskogo Obshchestva Ispytateley Prirody. Novaya Seriya. Otdel Biologicheskiy* [*Bulletin of the Moscow Society of Naturalists. New Series. Biological Section*], Tom 65, Vypusk 4, 1960, p. 120–21, illus. [*Phoca Sibirica*.]

MEDICAL SCIENCES

Andersen, K. Lange, *and others*. Metabolic and thermal response to a moderate cold exposure in nomadic Lapps. By K. Lange Andersen, Y. Løyning, J. D. Nelms, O. Wilson, R. H. Fox and A. Bolstad. *Journal of Applied Physiology*, Vol. 15, No. 4, 1960, p. 649–53, diagrs., tables.

Adams, Thomas. The control of body temperature. *Arctic Aeromedical Laboratory* (*Ladd Air Force Base Alaska*) *Technical Report* 59-21, 1960, 32 p.

Adams, Thomas. Environmental factors influencing thermal exchange. *Arctic Aeromedical Laboratory* (*Ladd Air Force Base, Alaska*) *Technical Report* 59-22, 1960, 54 p., diagrs. [Description of physical phenomena ultimately involved in heat fluxes and avenues of thermal exchange.]

Carlson, L. D. Nonshivering thermogenesis and its endocrine control. *Arctic Aeromedical Laboratory*, (*Ladd Air Force Base, Alaska*) *Technical Report* No. 61–1, 1960, 16 p., diagrs.

Milan, Frederick A. A study of the maintenance of thermal balance in the eskimo. *Arctic Aeromedical Laboratory* (*Ladd Air Force Base Alaska*) *Technical Report* 60-40, 1960, 20 p., tables, diagrs.

Freeman, Walter J., *and* Hemingway, Allan. Nervous control of shivering. 8. Further observations on brainstem unit potentials during shivering. *Arctic Aeromedical Laboratory* (*Ladd Air Force Base, Alaska*), *Technical Report*, 58-4, 1960, 26 p., diagrs.

HEROUX, O. The effect of intermittent indoor cold exposure on white rats. *Canadian Journal of Biochemistry and Physiology*, Vol. 38, 1960, p. 517–21, tables.

CARLSON, L. D., *and* THRUSH, H. L., *comps.* Protection of the extremities in extreme cold: a selected, annotated bibliography. *Arctic Aeromedical Laboratory* (*Ladd Air Force Base, Alaska*), *Technical Report*, 59–19, 1960, 60 p.

STARKOV, P. M., *ed. The problem of acute hypothermia, translated from the Russian by R. E. Hammond, edited by E. Neil.* London, Pergamon Press, (c1960). 319 p., illus., tables, diagrs. 22 cm. 70s. [Collection of papers by different authors mostly on laboratory experiments on small mammals.]

CARLSON, L. D., *and* THRUSH, H. L., *comps.* Human acclimatization to cold. A selected, annotated bibliography of the concepts of adaptation and acclimatization as studied in man. *Arctic Aeromedical Laboratory* (*Ladd Air Force Base, Alaska*), *Technical Report* 59-18, 1960, 133 p.

IRVING, LAURENCE, *and others.* Metabolism and temperature of Arctic Indian men during a cold night. *Journal of Applied Physiology*, Vol. 15, No. 4, 1960, p. 635–44, tables, diagrs.

REINHARD, KARL R. Experiences in veterinary aspects of public health in Alaskan Eskimo communities. *Journal of the American Veterinary Medical Association*, Vol. 134, No. 12, 1959, p. 535–40, illus., map. [Measures against rabies.]

[ILES KERGUELEN : MEDICAL ORGANIZATION] Médicine en vase clos. *T.A.A.F. Terres Australes et Antarctiques Françaises*, No. 11, 1960, p. 14–31, tables. [Account of work of health service at Iles Kerguelen.]

HILDES, J. A., *and others.* Old Crow—a healthy Indian community. By J. A. Hildes, Robert Whaley, Helen Whaley and Laurence Irving. *Canadian Medical Association Journal*, No. 81, 1959, p. 837–41, map, tables.

CARLSON, L. D., *and* THRUSH, H. L. *comps.* Cold injury and frostbite: a selected, annotated bibliography. *Arctic Aeromedical Laboratory* (*Fort Wainwright, Alaska*) *Technical Report*, 59-20, 1960, 62 p., tables.

ABBS, OTTO. Das Krankheitsbild der sogenannten "Lungenerfrierungen" in hohen Breiten. *Wehrmedizinische Mitteilungen*, 9, 10, 1960, 7 p. (Reprint.) [Study of "lung chill" in high latitudes.]

WILLIS, J. S. Mental health in the north. *Medical Services Journal, Canada*, September 1960, p. 689–720, illus. [Disorders precipitated by restricting circumstances of Canadian Arctic winter.]

WILLIAMS, RALPH B., *and* DODSON, MARIE W. Salmonella in Alaska. *Public Health Reports*, Vol. 75, No. 10, 1960, p. 913–16, tables. [21 years' observations of occurrence of salmonellosis in humans, dogs, fur seal pups, seal lice and gulls.]

TELECOMMUNICATION ENGINEERING

MCDONALD, FERGUS G. Tests made on 50 year old wire from the Antarctic. *British Communications and Electronics*, March 1961, 3 p., illus.

BARCLAY, L. W. Reception of B.B.C. television sound transmissions on 41·5 mc/s at Halley Bay, Antarctica. *Journal of British Institution of Radio Engineers*, Vol. 21, No. 1, 1961, p. 89–92, tables, diagrs. [Transmissions monitored on 130 days between April and October 1958.]

MINING

CAMERON, A. BRYCE. Queen Elizabeth Islands of Arctic Canada and their petroleum prospects. *Journal of the Institute of Petroleum*, Vol. 47, No. 449, 1961, p. 129–61, illus., maps.

INGSTAD, HELGE. Fra Sverdrup-øyene til Svalbard. *Polarboken*, 1959–60, p. 113–22, illus., maps. [Plans for exploiting oil resources on Sverdrup Islands and other Canadian Arctic islands.]

SPROULE, J. C. Natural resources prospects of the Canadian Arctic. *Western Miner and Oil Review*, Vol. 34, No. 1, 1961, p. 31–35, illus., map.

SPROULE, J. C. Arctic Islands exploration. *Canadian Oil and Gas Industries*, January, 1961, p. 23–28, maps, diagr. [Exploitable potentialities of Canadian Arctic Island discussed.]

[CANADA : OIL RESOURCES] Commercial development in the Queen Elizabeth Islands. *Arctic Circular*, Vol. 13, No. 2, 1960, p. 25–26. [Prospecting by commercial companies following publication of 1960 Canada Oil and Gas regulations.]

ELVER, R. B. Survey of the Canadian iron ore industry during 1959. *Ottawa, Department of Mines and Technical Surveys, Mineral Resources Division, Mineral Information Bulletin* MR 45, 1960, viii, 121 p., maps, tables, diagrs.

LYUDOGOVSKIY, G. I., *ed. Razvitiye proizvoditel'nykh sil Vostochnoy Sibiri. Chernaya metallurgiya* [*Development of productive forces of eastern Siberia. Ferrous metallurgy*]. Moscow, Izdatel'stvo Akademii Nauk SSSR [Publishing House of the Academy of Sciences of the U.S.S.R.], 1960. 275 p., maps. 27 cm. [Papers read at conference, 1958.]

CIVIL ENGINEERING

BEREZANTSEV, V. G. The strength of permafrost under building foundations. *Arctic Construction and Frost Effects Laboratory Translation* No. 31, 1960, diagrs. [Includes a modified revision of Prandtl's formula to determine critical load on frozen ground foundations.]

SAVARENSKIY, F. P. Dams in permafrost regions. *Arctic Construction and Frost Effects Laboratory, Translation* No. 29, 1960, 2 p. [Examples of damage caused by disruption of natural thermal regime in river bed.]

KORUNOV, M. M. Load-carrying capacity of ice for timber transport. Translated by M. Howson. *Canada, National Research Council, Technical Translation*, 863, 1960, 12 leaves, tables. (From *Lesnaia Prom*, Vol. 11, 1956, p. 18–19.)

PESCHANSKIY, I. S. Solntse i led. Novyye metody uskoreniya tayaniya [Sun and ice. New methods of speeding melting]. *Priroda* [*Nature*], 1960, No. 7, p. 49–54, illus., map. [Experimental use of dark material scattered from aircraft at points along Northern Sea Route.]

DUNBAR, MAXWELL JOHN. *Preliminary report on the Bering Strait scheme.* Ottawa, Dept. of Northern Affairs and National Resources, Northern Co-ordination and Research Centre, 1960. 17 leaves, maps. 27½ cm. (NCRC-60-1.) [Review of feasibility of Russian scheme and possible climatic effects.]

ANDEREGG, J. A., *and others.* "Ice water" on tap for the Arctic: pneumatic purging system, protected by simple air-lock device makes fill-and-draw water supply workable in sub-zero weather. By J. A. Anderegg, G. L. Hubbs and E. R. Eaton. *Water Works Engineering*, July 1960, illus., map, diagrs., 4 p. (Reprint.)

ANDEREGG, J. A., *and others.* "Eskimo" algae make lagoons work at the Arctic Circle. *Wastes Engineering*, June 1960, 3 p., illus., map, diagr. (Reprint.) [Sewage disposal.]

TRANSPORT ENGINEERING

KARTASHOV, S. N. Skolzheniye po snegu pri nizkikh temperaturakh [Sliding on snow at low temperatures]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 19, 1960, p. 18–20. [Effect on skis and runners of changes in friction due to temperature, with suggested counter-measures.]

YEVSTYUSHIN, NIKOLAY IVANOVICH. *Razvitiye aerosannogo transporta v SSSR* [*Development of airscrew-driven sledge transport in the U.S.S.R.*]. Moscow, Izdatel'stvo Akademii Nauk SSSR [Publishing House of the Academy of Sciences of the U.S.S.R.], 1959. 292 p., illus. 22 cm.

[ICEBREAKERS] *22000 s.h.p. polar type icebreakers Moskva and Leningrad.* Helsinki, Wärtsilä-Koncernen A/B, 1960. 20 p., illus. 11 cm. [Outline specification of these vessels.]

[ICEBREAKERS] *Need for coast guard icebreakers. Hearings before the Subcommittee on Merchant Marine of the Committee on Merchant Marine and Fisheries, House of Representatives . . . on H.R. 4 . . . and H.R. 288 a bill to authorize the construction of a nuclear-powered icebreaking vessel for operation by the U.S. Coast Guard . . . .* Washington, D.C., Govt. Printing Office, 1959. 65 p. 23 cm.

POZNYAK, I. I., *and others.* Issledovaniya v oblasti ledokolostroyeniya [Studies in icebreaker construction. By I. I. Poznyak, Yu. N. Popov, A. Ya. Sukhorukov]. *Problemy Arktiki i Antarktiki* [*Problems of the Arctic and Antarctic*], Vypusk 4, 1960, p. 130–38. [Summary of work done in Arctic Institute since 1935 on problems of capabilities of ships in ice.]

ENKVIST, E. The launching of a large icebreaker. *European Shipbuilding*, Vol. 9, No. 2, 1960, p. 28–46, illus., diagrs. (Reprint). [Describes measures taken to avoid damage to *Moskva* while launching, January, 1959.]

MACDONALD, SCOT. Helicopters in Antarctica, part two. *Naval Aviation News*, December 1960, p. 13–17, illus. [Different uses to which helicopters are put.]

BROWNE, W. A. Stations of the R.C.A.F. Goose Bay. *Roundel*, Vol. 12, No. 10, 1960, p. 8–11, illus.

[ANTARCTICA : AIRPORTS] Naval air facility, McMurdo Sound. *Bulletin, U.S. Antarctic Projects Officer*, Vol. 2, No. 4, 1960, p. 12–13, map. [Map.]

AGRICULTURE

PALOMÄKI, MAURI. Suomen sodanjälkeisen asutustoiminnan alueellisia piirteitä. *Terra*, Årg. 72, No. 4, 1960, p. 149–63, illus., maps. [Land settlement in Finland after Second World War; includes north Finland. English summary.]

HILL, D. E., *and* TEDROW, J. C. F. Weathering and soil formation in the Arctic environment. *American Journal of Science*, Vol. 259, No. 2, 1961, p. 84–101, illus., tables, diagrs. [Laboratory experiments on Arctic Brown soil.]

BERGGREN, ANNIKA. Myrslåtter i Vittangi. *Norrbotten*, 1960, p. 82–105, illus., map. [Grass mowing on outlying bogs at Vittangi, Torne Lappmark, north Sweden (especially tools and methods), 1900–1930's.]

DOMESTIC ANIMALS. LIVESTOCK

NORDKVIST, MAGNUS. Renens sjukdomar. Kort översikt. *Lappväsendet—Renforskningen. Småskrift*, [Nr.] 4, 1960, 28 p., illus. [Diseases in domestic reindeer.]

ERIKSSON, STURE. Idisslarnas proteinförsörjning. *Samefolkets Egen Tidning*, 1960, Nr. 10–11, p. 168–69. [Need of additional fodder to ensure sufficient protein intake in reindeer.]

RYDBERG, AXEL. Renens energibehov. *Samefolket*, 1961, Nr. 1, p. 17–20, illus. [Calorie needs of domestic reindeer.]

HØYRUP, FRITS. Hverdag i Eqaluit. *Grønland*, 1960, Nr. 11, p. 425–35, illus. [Impressions of sheep farm at Eqaluit, south-west Greenland.]

HUNTING. FISHING

NØIS, DANIEL. Litt om fangstlivet på Svalbard i gammel og ny tid. *Polarboken*, 1959–60, p. 94–102, illus. [Episodes from hunters' winterings in Svalbard.]

RØSTAD, SVERRE. Noen utsnitt fra dagboka—Friluftsliv i Myggbukta. *Polarboken*, 1959–60, p. 72–78, illus. [Hunting episodes at Norwegian meteorological station Myggbukta, east Greenland.]

MCLAREN, I. A., *and* MANSFIELD, ARTHUR W. The netting of sea mammals; a report on the Belcher Island experiment, 1960. *Fisheries Research Board of Canada, Arctic Unit, Montreal, Circular* No. 6, 1960, 13 p., maps, tables.

ABSETZ, BRAD. Seal hunting—my finest adventure. *Finlandia Pictorial*, Vol. 17, No. 1, 1961, p. 5–7, illus. [Brief account of methods; gulf of Bothnia.]

[GREENLAND WATERS : FISHERIES RESEARCH] East Greenland fishing. *Fisheries Laboratory Lowestoft, Laboratory Leaflet* No. 25, 1960, [5] leaves, maps. [Cod investigations by R.V. *Ernest Holt*, 1960.]

MATHIESON, R. S. Economic trends in the Alaskan salmon industry. *Australian Geographer*, Vol. 8, No. 1, 1960, p. 17–24, illus., map. [General account and future prospects.]

MEYER, A. Gute Kabeljaufangaussichten für Südgrönland? *Informationen für die Fischwirtschaft*, Jahrg. 7, Nr. 5/6, 1960, p. 131–35, illus. [Prospects for cod fisheries off south Greenland, 1960–61; statistics.]

CHITTLEBOROUGH, R. G. Australian catches of humpback whales, 1959, prepared for the International Commission on Whaling. *Commonwealth Scientific and Industrial Research Organisation, Division of Fisheries and Oceanography*, Report 29, 1960, 44 p., tables, diagrs.

[WHALING INDUSTRY. NORWEGIAN] The whaling monument in Sandefjord. *Norsk Hvalfangst-Tidende*, Årg. 49, Nr. 7, 1960, p. 299–300, 302, illus. [In Norwegian and English.]

[WHALING : ANTARCTIC] Pelagic activities in the Antarctic. *Dept. of Commerce, Division of Fisheries* (Pretoria) *29th Annual Report* 1957–1958, p. 8–9, table. [Summary of South Africa activities 1957–58.]

[WHALING COMPANIES] Tabulated information respecting Norwegian whaling companies. *Norsk Hvalfangst-Tidende*, Årg. 49, Nr. 4, 1960, p. 180–81. [Date formed, managing firm or manager, factory ships, shore stations and catchers, whaling ground, number of crew, catch results in barrels, 1957–60.]

TANAKA, KAZUO, *and* NISHIMOTO, JUN-ICHI. Determination of the time required for freezing of whalemeat. *Journal of the Tokyo University of Fisheries*, Vol. 47, No. 1, 1960, p. 81–92, diagrs.

HARAM, HARALD ODD. En særpreget norsk og kanadisk næringsveg. Selfangsten ved Newfoundland og Labrador. *Polarboken*, 1959–60, p. 79–90, illus., map. [History of Newfoundland and Labrador sealing, particularly Norwegian participation.]

SELLÆG, JOHANNES. Tilfredstillende utbytte av selfangsten i de senere år. *Polarboken*, 1959–60, p. 131–33. [Norwegian Arctic sealing statistics, 1957–60.]

POSTAL SERVICES. PHILATELY

GRAPE, ERNST. Ur Norrbottens äldre posthistoria—några anteckningar. *Norrbotten*, 1960, p. 145–81, illus., map. [History of postal services (middle of seventeenth to end of nineteenth century), Norrbottens län, north Sweden.]

VESPER, HANS EGON. *Die Post in der Antarktis*. Düsseldorf–Oberkassel, Poststempelgilde "Rhein-Ronau" e.V., [1960?]. 163 p., illus. 19 cm. [Historical survey of stamps and covers in the Antarctic and sub-Antarctic.]

TRANSPORT BY SLEDGE

DALINGER, RENE E., *and* RICCI, EMILIO. Normas tecnico-practicas para efectuar un viaje en trineo tirado por perros. *Contribucion del Instituto Antártico Argentino*, No. 39, 1959, 22 p., illus. [Equipment, food and dog-sledging techniques practised at Antarctic base General San Martín, 1957–58.]

WEIHAUPT, JOHN G. *Logistics of the Victoria Land traverse, Antarctica, 1959–1960*. Montreal, Arctic Institute of North America, [1960]. 13 leaves, tables. [Lists of food, clothing, equipment and locations and inventories of depots laid.]

THE ARTS. ARCHITECTURE. ENTERTAINMENT. RECREATION

GROVEN, EIVIND. *Eskimomelodier fra Alaska (Helge Ingstads samling av opptak fra Nunamiut). Studier over tonesystemer og rytmer*. [No place of publication, n.d.] 170 p., map. 29 cm. [Study of tonal systems and rhythm in Eskimo music from Alaska, recorded by Helge Ingstad among the Nunamiut.]

EXPEDITIONS. HISTORY OF EXPLORATION

Arctic

LARSEN, HELGE, *ed. Danish Arctic research 1955–1959. Report from Arktisk Institut 1–5*. Charlottenlund, Arktisk Institut, 1960. 77 p. 25 cm. [Geological, geophysical, archaeological, biological, anthropological and sociological work mainly in Greenland; list of scientific Arctic publications by Danes and by foreign scientists working for Danish institutions.]

GREKOV, VADIM IVANOVICH. *Ocherki iz istorii russkikh geograficheskikh issledovaniy v 1725–1765 gg.* [*Outline of the history of Russian geographical explorations, 1725–65*]. Moscow, Izdatel'stvo Akademii Nauk SSSR [Publishing House of the Academy of Sciences of the U.S.S.R.], 1960. 426 p., maps. 27 cm.

AHLMANN, HANS W:SON. Professor Somov och den aktuella polarforskningen. *Ymer*, Årg. 80, Hft. 4, 1960, p. 250–55, map. [Soviet research in Arctic Ocean; M. M. Somov's contribution.]

HEINTZ, ANATOL. Reise til Spitsbergen for 153 [*sic*] år siden. *Polarboken*, 1959–60, p. 103–12. [Translation of letter in German by Barto von Löwenigh about journey from Hammerfest to Svalbard, 1827.]

POWELL, THEODORE. *The long rescue; the story of the tragic Greely expedition*. London, W. H. Allen, 1961. 303 p., illus., map, 22½ cm. 25*s*. [Expedition to Ellesmere Island and Greenland 1881–84, leader Adolphus Greely.]

BLANCHET, GUY. *Search in the north*. Toronto, Macmillan, 1960. 197 p., illus., maps. 22 cm. $4.50. [Story of early use of aeroplanes for mineral prospecting in Canadian Arctic.]

NOBILE, UMBERTO. *My polar flights: an account of the voyages of the airships Italia and Norge. Translated by Frances Fleetwood*. London, Frederick Muller, [°1960]. 288 p., illus., map. 21 cm. 25*s*.

SZUPRYCZŃSKI, JAN. 2 sympozjum naukowe poświęcone omówieniu prac badawczych polskiej wyprawy na Spitsbergen w latach 1957–1958–1959. *Przeglad Geograficzny*, Tom 32, Zesyt 3, 1960, p. 442–43. [Report of symposium on scientific results of Polish Spitsbergen expeditions, 1957–59.]

CALVERT, JAMES. *Surface at the Pole: the story of USS Skate*. London, Hutchinson, 1961. viii, 220 p., illus., maps. 22 cm. 16*s*. [Story of two trans-polar voyages of U.S. Navy submarine *Skate*, 1958, and 1959, Cmdr, James Calvert.]

KRANCK, E. H. En resa till Axel Heibergs Land, 1959. *Nordenskiöld-Samfundets Tidskrift*, Årg. 20, 1960, p. 62–81, illus. [Reconnaissance trip, 1959, for Jacobsen–McGill University expedition (glaciology and geology), 1959–61, to Axel Heiberg Island, Northwest Territories, Canada.]

Antarctic

COOK, JAMES. *The explorations of Captain James Cook in the Pacific, as told by selections of his own journals 1768–1779. Edited by A. Grenfell Price. Illustrated by Geoffrey C. Ingleton.* Melbourne, Georgian House, 1958. [xx], 292 p., port., illus., maps (on end papers). 27 cm. 70s. [From Hakluyt Society text. *De luxe* edition published New York, 1957 for limited Editions Club.]

VICTOR, PAUL-ÉMILE. Il y a dix ans...en Terre Adélie. *T.A.A.F. Terres Australes et Antarctiques Françaises*, No. 11, 1960, p. 8–12, illus. [Summary of work accomplished by Expéditions Polaires Françaises after 10 years in Terre Adélie.]

DÍAZ, EMILIO. *Relatos antárticos.* Buenos Aires, Editorial Losada, S.A., [©1958]. 272 p., illus., maps. 24½ cm. [Argentine naval officer's experiences in Antarctic 1940–1957. Includes diary of Teniente Jorge Yalour, second-in-command of *Uruguay* during rescue of Nordenskjold's *Antarctic* expedition, 1903.]

TRESHNIKOV, A. F. Sovetskiye issledovaniya v Antarktike [Soviet studies in the Antarctic]. *Problemy Arktiki i Antarktiki* [*Problems of the Arctic and Antarctic*], Vypusk 4, 1960, p. 15–25. [Summary of work by first five Soviet Antarctic expeditions, 1955–60.]

SOMOV, MIKHAIL MIKHAYLOVICH. Sovjetiska forskningar i Antarktis 1955–1959. *Ymer*, Årg. 80, Hft. 4, 1960, p. 241–49, illus., maps. [Soviet research in Antarctic, 1955–59.]

LAPLACETTE, ALBERTO PATRON. La campaña antártica 1957–58. *Contribución del Instituto Antártico Argentino* No. 31, 1959, 22 p., maps. [Argentine Navy's Antarctic campaign of 1957–58. Outline of scientific work.]

DRALKIN, A. G. K yuzhnomy polyusu [To the South Pole]. *Priroda* [*Nature*], 1960, No. 9, p. 48–55, No. 10, p. 27–34, illus. [Narrative of Soviet overland journey from "Vostok" to South Pole, December 1959.]

BLACKWELL, M. J. Recent scientific activities at Halley Bay: International Geophysical Co-operation, 1959. *Nature*, Vol. 187, No. 4742, 1960, p. 982–84. [Summary of work in meteorology, glaciology, geomagnetism, and biology during 1959 Antarctic season.]

SKLYAROV, V. M. Pamyati pogibshikh tovarishchey [In memory of lost comrades.] *Meteorologiya i Gidrologiya* [*Meteorology and Hydrology*], 1960, No. 10, p. 59–63. [Obituary notices of 8 members of Soviet Antarctic expedition who died in fire at Mirnyy, 3 August 1960.]

MCDONALD, EDWIN ANDERSON. Antarctic break-through. *Explorers Journal*, Vol. 39, No. 1, 1961, p. 12–21, illus., maps. [Voyage of U.S.S. *Glacier* and *Burton Island* through pack ice in Bellingshausen Sea, February 1960.]

BIOGRAPHY

KOSIBA, ALEKSANDER. Działalność naukowa profesora Henryka Arctowskiego. *Acta Geophysica Polonica*, Vol. 7, No. 3/4, 1959, p. 250–95, illus. [Account of Arctowski's scientific work, with bibliography. English summary.]

KNUTH, EIGIL. *Aron of Kangeq 1822–1869. The seal hunter who became father of Greenland's art of painting.* Copenhagen, Danish National Museum, 1960. 24 p., illus. (plates). 28 cm. [Life, background and work of Greenlandic artist and writer.]

LUND, THORALV. Ishavets Münchhausen. *Polarboken*, 1959–60, p. 91–93, illus. [Note on Svalbard hunter Georg Bjørnnes.]

SWAN, R. A. A nineteenth-century "new Australian" in the Antarctic: the remarkable achievements of Carstens Egebert Borchgrevink, leader of the British Antarctic Expedition, 1898 to 1900. *Royal Australian Historical Society, Journal and Proceedings*, Vol. 46, 1960, Part 1, p. 1–23. [Biography.]

FREUCHEN, PETER. *Peter Freuchen's adventures in the Arctic. Edited by Dagmar Freuchen.* New York, Julian Messner, [©1960]. 383 p., illus. 21 cm. $4.95. [Autobiography edited posthumously by author's wife.]

[BIOGRAPHY] V. V. Frolov. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 23, 1960, p. 42. [Obituary notice of Director of Arctic and Antarctic Research Institute, Leningrad.]

INGSTAD, HELGE. Den nye direktør for Norsk Polarinstitutt. *Polarboken*, 1959–60, p. 134–35, illus. [Note on new director of Norsk Polarinstitutt, Tore Gjelsvik.]

[BIOGRAPHY] [M. André Gougenheim]. *T.A.A.F. Terres Australes et Antarctiques Françaises*, No. 11, 1960, p. 49, illus. [Brief biographical note on retiring president of Comité National Français pour les Recherches Antarctiques.]

NIELSEN, NIELS. Gudmund Hatt, 31. oktober 1884–27. januar 1960. *Geografisk Tidsskrift*, Bd. 59, 1960, p. vi–vii. [Obituary of Danish ethnologist.]

LAZELL, J. ARTHUR. *Alaskan apostle, the life story of Sheldon Jackson.* New York, Harper and Brothers, [©1960]. 218 p., illus., maps. 21 cm. $4.50. [Missionary in Alaska and Siberia 1877–1903.]

[Biography] [M. Georges Laclavère] *T.A.A.F. Terres Australes et Antarctiques Françaises*, No. 11, 1960, p. 50, illus. [Biographical note on new president of Comité National Français pour les Recherches Antarctiques.]

[Medals] [Founder's medal awarded to Mr Phillip Law]. *Geographical Journal*, Vol. 126, Part 3, 1960, p. 383.

Neatby, L. H. McClure and the passage. *Beaver*. Outfit 291, Winter 1960, p. 33–41, illus., map. [Reassessment of McClure's character and achievements from diary kept by Moravian missionary, Johann Miertsching, who was on board *Investigator* during 1850–54 Franklin Search expedition.]

Mikkelsen, Ejnar. *Svundne tider i Østgrønland. Fra stenalder til atomtid*. København, Gyldendal, 1960. 238 p., illus. 24 cm. 24.75 *D.kr.* [Fifth and last volume of autobiography covering author's time as inspector of east Greenland 1933–39 and 1945–50.]

Nielsen, Niels. Keld Milthers. 29. april 1907–2. marts 1960. *Geografisk Tidsskrift*, Bd. 59, 1960, p. vi–vii. [Obituary of Danish geologist.]

Mikkelsen, Ejnar. Johan Petersen. *Grønland*, 1961, Nr. 2, p. 79–80, illus. [Obituary of first factor at Angmagssalik and Scoresbysund, east Greenland.]

Ronne, Finn. The lure of exploration. *Polarboken*, 1959–60, p. 7–33, illus., map. [Author's four expeditions to Antarctic 1933–35 (Byrd), 1939–41 (Byrd), 1946–48 (Ronne), 1956–57 (in charge of IGY station Ellsworth.)]

[Biography] Profile, Gerald Seligman. The science of snow, ice and mountains. *New Scientist*, No. 224, March 1961, p. 538–39, illus.

Grigor'yev, A. A., *and* Shevelev, M. I., *eds. O. Yu. Shmidt. Izbrannyye trudy. Geograficheskiye raboty* [*O. Yu. Shmidt. Selected works. Geographical papers*]. Moscow, Izdatel'stvo Akademii Nauk SSSR [Publishing House of the Academy of Sciences of the U.S.S.R.], 1960. 214 p., illus., maps. 27 cm. [Works chiefly relating to exploration of Soviet Arctic in 1940's. Biographical introduction by A. A. Grigor'yev.]

POLAR REGIONS IN GENERAL

Svalbard

Skevik, Kaare. En pionérinnsats som ikke førte frem. *Polarboken*, 1959–60, p. 59–65, illus. [Tourist traffic to Spitsbergen by Norwegian ship *Lofoten* 1896–98.]

Greenland

Therkilsen, Kjeld Rask. Greenland looks ahead. *Geographical Magazine*, Vol. 33, No. 10, 1961, p. 545–55, illus., map. [Survey of modern development in Greenland.]

Oldendow, Knud. Den grønlandske avis fylder hundrede år. *Grønland*, 1961, Nr. 1, p. 1–14, illus. [History of Greenland periodical *Atuagagdliutit/Grønlandsposten*, 1861–1960.]

[Greenland : Statistics] Statistiske oplysninger om udviklingen i Grønland 1948–1958. *Beretninger vedrørende Grønland*, 1960, Nr. 6, 52 p. [Greenland statistics (population, health, schools, church, courts, production, import and export, retail trade, incomes, wages and prices, public finance) 1948–58.]

Knudsen, Helge. De sociale forhold i Grønland. *Grønland*, 1960, Nr. 11, p. 401–17, illus. [Organization of social welfare in Greenland.]

Bertelsen, Harald. En sten på pædagogens vej.... *Grønland*, 1961, Nr. 1, p. 35–38. [Educational problems arising from Greenlanders' traditional reserve and bashfulness.]

Lund, Kaj Budde. Grønland og den europæiske frihandelssammenslutning. *Grønland*, 1960, Nr. 11, p. 418–24, illus. [Reasons for and against Greenland joining the European Free Trade Association.]

Oldendow, Knud. *Bogtrykkerkunsten i Grønland og mændene bag den. En boghistorisk oversigt*. København, [F. E. Bording], 1957. 235 p., illus., maps. 25½ cm. [History of printing and publishing in Greenland.]

[Greenland] *Billet til Grønland—og hvad så?* [København], Ministeriet for Grønland, 1960. 122 p., illus., map. 19½ cm. [Practical advice on all aspects of life in Greenland for visitors and temporary residents. List of inhabited places.]

Soviet Arctic

Belov, M. I. Issledovaniya po istorii sovetskogo severa [Studies in the history of the Soviet north]. *Problemy Arktiki i Antarktiki* [*Problems of the Arctic and Antarctic*], Vypusk 4, 1960, p. 7–14. [Summary of historical and archaeological works on Soviet Arctic published since 1917.]

Gromov, Leonid Vasil'yevich. *Oskolok drevney Beringii* [*A fragment of ancient Beringia*]. Moscow, Gosudarstvennoye Izdatel'stvo Geograficheskoy Literatury [State Publishing House for Geographical Literature], 1960. 96 p., illus. 20 cm. [Ostrov Vrangelya, where author wintered twice.]

Fayvushevich, V. Leningradskoye arkticheskoye uchilishche pered novym uchebnym godom [Leningrad Arctic training school at the start of the new school year]. *Morskoy Flot* [*Merchant Fleet*], 1960, No. 9, p. 39–40. [Work of institution which trains technical personnel for ships and shore stations in Soviet Arctic.]

Armstrong, Terence Edward. La route maritime du Nord. *Cahiers du Monde Russe et Soviétique* (Paris), Vol. 1, No. 3, 1960, p. 466–81. [Includes analysis of freight movements.]

Scandinavia

Sømme, Axel, *ed. A geography of Norden. Denmark, Finland, Iceland, Norway, Sweden.* Oslo, J. W. Cappelen [c1960]. 363 p., illus., maps, tables. 27 cm. (Scandinavian University Books]. 57.00 *N.Kr.* [Includes chapters on Greenland, Jan Mayen and Svalbard.]

[Finland] Lapin tutkimusseura (The Research Society of Lapland). *Lapin Tutkimusseura*, Vuosikirja I, 1960, p. 72. [The Research Society of Lapland, established 1959. Outline of aims; address; publications.]

Toivola, Urho, *ed. Introduction to Finland 1960.* Porvoo, Helsinki, Werner Söderström, 1960. 313 p., illus., map. 21½ cm. [Politics, economy, education, arts and sport.]

Ohlson, Birger. Settlement and economic life in Enontekiö—a parish in the extreme north of Finland. *Fennia*, 84, 1960. Three faces of Finland. 2. E.F. 2. Physical and human geography of Finnish Lapland. 2, p. 21–46, illus., maps. [Summary in French.]

Ohlson, Birger. Sirkka, an agricultural village clearing in the coniferous region of western Lapland. *Fennia*, 84, 1960. Three faces of Finland. 2. E.F. 2. Physical and human geography of Finnish Lapland. 1, p. 5–20, illus., maps. [Geology, hydrography, climate, population and housing, forest and wasteland, agriculture, fishing and hunting. French summary.]

Okko, Veikko. Kemi, centre of the wood processing industry of northern Finland. *Fennia*, 84, 1960. Three faces of Finland, 2. E.F. 2. Physical and human geography of Finnish Lapland. 3, p. 47–61, maps. [Development of and conditions for wood processing industry in Kemi; includes resources of raw material, motive power and transport of raw material in Finnish Lapland. Summary in French.]

Niiranen, Esko. The city of Rovaniemi, capital of Finnish Lapland. *Fennia*, 84, 1960. Three faces of Finland. 2. E.F. 2. Physical and human geography of Finnish Lapland. 4, p. 63–81, illus., maps. [Destruction and reconstruction, layout, population, role as regional centre, traffic and communications, economic life, future prospects. French summary.]

Tenerz, Hugo. Namnen i Tornedalen under 1500–, 1600– och 1700–talen. *Norrbotten*, 1960, p. 33–81, map. [Investigation of surnames and some place-names in Tornedalen, north Sweden, 16th to 18th centuries, especially in relation to settlement.]

Walin, Gösta. Naturvård på lång sikt. *Svenska Turistföreningens Tidning*, Årg. 28, Nr. 6, 1960, p. 178–79, illus. [Arguments for preservation of nature and against exploitation of water power, north Sweden.]

Isaksson, Olov. Norrbottens län 150 år. *Norrbotten*, 1960, p. 9–32, illus. [Series of pictures, with explanatory text, from exhibition (1960) at Norrbottens Museum, Luleå, north Sweden, illustrating history of Norrbottens län.]

Vorren, Ørnulv, *ed.* Norway north of 65. *Tromsø Museums Skrifter*, Vol. 8, 1960, 271 p., illus., maps. [Geology, climate, flora and fauna, settlement, Lapps, economic structure, agriculture, reindeer industry, fisheries, sealing and whaling, industry and mining, communications, education, science and the arts.]

Landmark, K., *and others.* Northern Norway: nature and livelihood. By K. Landmark, E. Løkse, J. Vikingstad and Ø. Vorren. *Norsk Geografisk Tidsskrift*, Bd. 17, Hft. 1–4, 1959–60, p. 138–67, illus., maps. [Geology, geomorphology, fisheries and agriculture; Nordland and Troms, north Norway.]

Antarctic

[Antarctica : Sailing Directions] *Sailing directions for Antarctica including the off-lying islands south of latitude 60° S. Second edition 1960.* Washington, D.C., Government Printing Office, 1960. xiv, 432 p., illus., map, tables. 29 cm. $4.50. (H.O. Publication No. 27.) [Reprint of first edition in loose-leaf form.]

Aver'yanov, V. G. Granitsa Tsentral'noy Antarktidy [The boundary of central Antarctica]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin*

of the Soviet Antarctic Expedition], No. 20, 1960, p. 5–9. [3000-metre contour suggested as good orographic and climatic dividing line for suggested natural region.]

[Antarctic : Committees] C.N.F.R.A. Comité National Français des Recherches Antarctiques. Sixième Réunion. *T.A.A.F. Terres Australes et Antarctiques Françaises*, No. 11, 1960, p. 47–48.

Belov, M. I. Oshibka ili umysel? Karty Piri Reysa i ikh amerikanskiye istolkovateli [Mistake or design? The maps of Piri Reis and their American interpreters]. *Priroda* [*Nature*], 1960, No. 11, p. 89–95, maps. [Argument that maps of Piri Reis of 1513 and 1528 do not show coast of Antarctica as alleged.]

[Antarctic : Medals] *Subcommittee No. 3 consideration of H.R. 3923....* Washington, D.C., House of Representatives Subcommittee No. 3 of the Committee on Armed Services, 1959. p. 2509–37. 23 cm. [Discussion of H.R. 3923 "A bill to provide for the presentation of a medal to persons who have served as members of a United States expedition to Antarctica". Includes a list of U.S. government departments and agencies interested in the Antarctic, p. 2524–27.]

Briesemeister, William A. The American Geographical Society's map of Antarctica. *Bulletin U.S. Antarctic Projects Officer*, Vol. 2, No. 5, 1961, p. 8–14, maps. [Map to be compiled from new data, 4 sheets at 1:3,000,000 or 1 sheet at 1:5,000,000.]

Dubovskoy, B. V. Kartograficheskiye raboty [Cartographic work]. *In*: Treshnikov, A. F., *ed. Vtoraya kontinental'naya ekspeditsiya 1956–1958 gg. Nauchnyye rezul'taty* [*Second continental expedition, 1956–58. Scientific results*] (Leningrad, 1960) [numbered "9"], p. 208–33. [Plan and realization for coastal area between long. 72° and 120° E.]

Ushakov, S. A. Nekotoryye cherty stroyeniya Berega Korolya Georga V i Berega Otsa po geofizicheskim dannym [Some structural features of King George V Land and Oates Land from geophysical data]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 18, 1960, p. 11–14. [Deductions from seismic, gravimetric and geological observations made in 1958.]

Dubinin, A. I. "Ob'" u ostrova Petra Pervogo [*Ob'* at Peter I Øy]. *Informatsionnyy Byulleten' Sovetskoy Antarkticheskoy Ekspeditsii* [*Information Bulletin of the Soviet Antarctic Expedition*], No. 23, 1960, p. 5–9, map. [Visit in March 1960.]

Le Blond, Yves. Périple des Kerguelen. *T.A.A.F. Terres Australes et Antarctiques Françaises*, No. 11, 1960, p. 32–43, illus. [Account of boat journey round Iles Kerguelen.]

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